A·I·B·S

bulletin

NEWS AND VIEWS IN THE BIOLOGICAL SCIENCES

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contributors and contents

JANE M. OPPENHEIMER, Bryn Mawr College—*Problems, Concepts, and Their History; Methods and Techniques*

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PAUL WEISS, Rockefeller Institute for Medical Research, New York—*Nervous System (Neurogenesis)*

VICTOR TWITTY, Stanford University—*Vertebrate Organogenesis of the Eye*

C. L. YNTEMA, State University of New York Medical Center at Syracuse—*Vertebrate Organogenesis of Ear and Nose*

J. S. NICHOLAS, Yale University—*Vertebrate Organogenesis of Limb and Girdle*

W. M. COPENHAVER, College of Physicians and Surgeons, Columbia University—*Vertebrate Organogenesis of Heart, Blood Vessels, Blood and Entodermal Derivatives*

R. K. BURNS, Carnegie Institution of Washington and Johns Hopkins University—*Vertebrate Organogenesis of Urogenital System*

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MARY E. RAWLES, Johns Hopkins University—*Vertebrate Organogenesis of Skin and its Derivatives*

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NORMAN J. BERRILL, McGill University—*The Determination of Size*

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EDGAR ZWILLING, University of Connecticut—*Teratogenesis*

Edited by BENJAMIN H. WILLIER, Professor of Zoology, Johns Hopkins University, Baltimore, Md.; PAUL A. WEISS, Member, Rockefeller Institute for Medical Research, New York; and VIKTOR HAMBURGER, Professor of Zoology, Washington University, St. Louis, Mo. About 750 pages, 7" x 10", illustrated. *Ready in January, 1955.*

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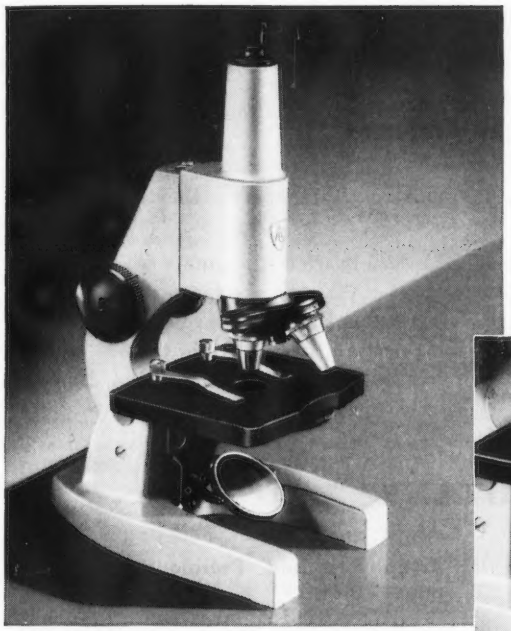

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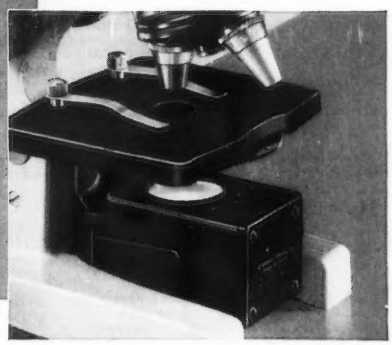

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EDITORIAL

THE past half century, and particularly the past decade, has brought dramatic changes in the Nation's health and its health resources—scientific funds, facilities, and manpower.

Our major health problems are now the chronic diseases, such as cancer, arteriosclerosis, and senile psychoses. These increase as infectious diseases decline in importance and the average life span lengthens. The relatively slight progress against chronic disease is reflected in the life expectancy of middle-aged people. Whereas the total life expectancy of white men has risen about 18.5 years since 1900, the life expectancy of 50-year-olds is now higher by only a little more than two years.

These and other population trends have resulted in a growing proportion of older people and a concomitant rise in disabling illness. By 1960 nearly a quarter of our population will be over 50, and the number of disabling illnesses will have mounted 25 percent. These statistics represent incalculable suffering as well as a tremendous socio-economic burden. They emphasize that little can be gained by prolonging life without at the same time preserving health.

The Nation's medical research effort, however, has shifted in response to the mounting importance of chronic disease. In all the life sciences today, research opportunity is unprecedented. For example, radioactive tracer techniques have greatly extended the biochemical approach to cancer.

Another encouraging development of recent years has been an increase in research support from industry, philanthropy and government. The Federal Government's expenditure for all scientific research has risen twentyfold since 1940—from slightly less than $100 million to an estimated $2 billion. In 1954 the life sciences received approximately $197 million for basic and applied studies; and though the total for all research will decline slightly in 1955, the life sciences will receive an estimated $212 million.

A large proportion of the Federal appropriation in the field of medical research is granted to universities and other nonprofit institutions. The National Institutes of Health, research arm of this Department's Public Health Service, received Congressional appropriations for 1955 totaling $81.3 million, of which $54.3 million, or 67 percent, will be awarded to non-Federal investigators.

Although the support of biological research has been increasing over the years, an alarming shortage of scientific manpower is developing. This is a complex situation involving several interrelated trends—namely, a growing demand for scientists in industry and government, and simultaneous declines in the numbers teaching science at high school and college levels, in those receiving college degrees in scientific fields and in high school students prepared to enter scientific training.

The prospective supply of undergraduates and graduates is expected to be insufficient in the natural sciences, engineering, medicine, psychology, dentistry and nursing for the next several years. In 1951, graduates with natural-science degrees totaled 49,000, of whom 20,500 entered employment in corresponding fields that year. Annually through 1957, only about 36,000 degrees will be awarded in the natural sciences. The future demand for biological scientists is expected to be large, but to vary considerably among the specialties.

College graduates prepared to teach high school science subjects reached a peak of 9,100 in 1950 and have since declined to 4,000, a drop of 56 percent. The decline in graduates prepared to teach high school biology was 54 percent. These figures become more meaningful when we consider that only a portion of these graduates actually enter teaching careers. Only 38 percent of the members of the 1953 class who were prepared to teach science in high school was so engaged in the fall of that year.

Several ways in which scientists and allied workers can help solve this manpower problem have been suggested by one scientist:

"First, we can take a more active interest in education at high school and college levels, serving to a greater extent as teachers, authors of textbooks, and other participants in the educational system. Second, we can try to interest our children in scientific and teaching careers, and can alert other parents to the shortage of scientific manpower. Third, we can aid and encourage promising college students to seek advanced scientific degrees. . . . Finally, many of us may be able to advance our own education, with a view to augmenting our productivity."[1]

Mrs. Oveta Culp Hobby
Secretary of Health, Education and Welfare

1 Sebrell, W. H., Jr. "Chemistry in Chronic Disease Research." Read before the Philadelphia Section of the American Chemical Society, Philadelphia, Pennsylvania, December 9, 1954.

Across the Editor's Desk

• **An important announcement about the deferment of graduate students was made recently in the form of a directive by President Eisenhower.**

In accordance with the directive, college students receiving the bachelor's degree may anticipate deferment for graduate study, provided they have attained a grade of 80 and are in the upper quarter of the graduating class. Chances of deferment will be still further improved if the student has been accepted in an accredited graduate school.

A graduate student can expect continued deferment until he has completed the work for the next higher degree, for his status may not be reviewed during this period. In the case of the master's degree, he will be allowed two years beyond the bachelor's; in the case of the doctor's degree, the allowance is three years beyond the master's; five beyond the bachelor's. He must, of course, maintain a satisfactory scholastic record throughout the period of graduate work.

The Scientific Manpower Commission, on which AIBS is represented, can be congratulated for its role in recommending to the President that the deferment situation be clarified. Assuming that these new regulations will be followed conscientiously by Selective Service local boards, state directors, and national headquarters, it can be concluded that the graduate problem has been effectively solved. If there is any apparent violation of the spirit and intent of the President's directive, the Scientific Manpower Commission (1530 P Street, N.W., Washington 5, D.C.) would appreciate receiving prompt, detailed reports of specific cases.

• **Federal commitments for research and development** in fiscal year 1955 will be cut approximately 10% from 1954, according to the recently issued National Science Foundation report "Federal Funds for Science, III." The largest decrease will be for plants and facilities but applied research and development will also drop somewhat. Obligations for basic research in the sciences, on the other hand, will increase $11,000,000. Of the twenty government agencies sponsoring research and development programs, seven will account for 98% of the 1955 total of $1,990,000,000, the Department of Defense alone accounting for 75%. The physical sciences will receive 87% of the gross, *the life sciences 11%*, and the social sciences 2%.

• **Michigan State College will be 100 years old this year.** It is particularly significant that the annual AIBS-sponsored meetings for 1955 will be held on this campus during its centennial year. Michigan State was founded in 1855 as the first agricultural college in the United States and was used as a model when the system of land-grant colleges was established by the Morrill Act of 1862. Its development has been steady until today it stands as the ninth largest institution of higher learning in the nation. Its student body exceeds 15,000 and its faculty totals more than 2,000.

Centennial plans include: *Founder's Day*, February 12, when Dr. James B. Conant, U.S. High Commissioner to Germany, will deliver an address; *A Series of Ten Scholarly Symposia*, including two of interest to biologists, "Nutrition of Plants, Animals and Man" (February 14-16), and "Reproduction and Infertility," Veterinary Symposium (June 27-29); *Centennial of Farm Mechanization*, August 15-20, a "world's fair" of modern and historical exhibits and demonstrations; *Presidential Convocation*, October 10-14, when President Eisenhower will deliver a speech; *National Meetings of Educational Groups*, including the Association of Land-Grant Colleges and Universities (November 15-17), **American Institute of Biological Sciences (September 5-9)**, National Poultry Science Association (August 9-12), the American Philosophical Association (April 28-30), and American Dairy Science Association (June 20-24).

• **A final report has been issued by the Atomic Energy Commission on the Predoctoral and Postdoctoral Fellowship Programs** that were conducted from May 1, 1948 until September 30, 1953, a period when no other major scientific fellowship program was in effect. With the formation of the National Science Foundation and its national fellowship program in the sciences, the AEC program was terminated. During the five years when AEC provided fellowships, 920 fellows received support, 522 for study in the predoctoral physical sciences, 213 in the predoctoral biological sciences, and 155 in the postdoctoral physical, medical, and biological sciences.

A limited number of copies of this final report are available for use by offices or officials concerned with administration of fellowship programs and may be obtained by writing to the University Relations Division, Oak Ridge Institute of Nuclear Studies, P.O. Box 117, Oak Ridge, Tenn.

• **Three $4,000 post-doctoral fellowships in Statistics are being offered for 1955-56 by the University of Chicago.** The purpose of these fellowships, which are open to holders of doctor's degree or its equivalent, is to acquaint established research workers in the biological, physical, and social sciences with the role of modern statistical analysis in the planning of experiments and in the analysis of empirical data. The closing date for applications is February 15, 1955; instructions for applying may be obtained from the Committee on Statistics, University of Chicago, Chicago 37, Ill.

• **The Lalor Foundation has announced a new program for 1955 to include 20 summer or interim awards** to college and university faculty members for study and research in which chemistry or physics is used to attack problems in any of the biological sciences. Each award will normally not exceed $900 to single men and women and $1,100 to married persons, but is subject to circumstances. The place of work may be at the faculty member's own institution or elsewhere. The Foundation plans to continue, for the eighth year, to underwrite awards of postdoctoral summer fellowships administered by the Marine Biological Laboratory at Woods Hole, Mass. Applications for the new faculty summer awards should be filed before January 15, 1955 and inquiries directed to C. L. Burdick, Director of the Lalor Foundation, 440 Lancaster Pike, Wilmington 5, Delaware. Inquiries about the Woods Hole postdoctoral summer awards should be directed to the Marine Biological Laboratory. Final filing date for these applications is February 1, 1955.

• **The September-October 1954 issue of *The Journal of Heredity* contains a deserving tribute to William Ernest Castle,** on the occasion of his 87th birthday. Fifteen of Dr. Castle's former graduate students were present at the celebration, held during the 25th anniversary of the Roscoe B. Jackson Memorial Laboratories: C. C. Little, Paul B. Sawin, D. F. Jones, Hugh McPhee, Karl Sax, Phineas Whiting, Sheldon C. Reed, George D. Snell, Sewall Wright, H. D. Fish, Laurence H. Snyder, W. H. Gates, Nelson Waters, Lloyd W. Law, and H. R. Hunt. The author of the article in *J. of Heredity* illustrates Dr. Castle's influence upon mammalian genetics by a "family tree" with the main branches, his doctoral students and other students who worked with him at the Bussey, and the students of these students who were present at the 25th anniversary symposium, "25 years of Progress in Mammalian Genetics and Cancer." A truly imposing number of American geneticists came under the influence of this pioneer scientist or his students at some time in their careers. E. S. Russell,

the author, writes, "The Jackson Laboratory is proud to pay homage on the occasion of his 87th birthday to William Ernest Castle, a wonderfully sincere, helpful and encouraging man whose career has provided a firm foundation for the establishment of the whole science of mammalian genetics."

• Also in this particular issue of *The Journal of Heredity* appears the second article ever written on **"African Violet Genetics,"** by the author of the first, Sheldon C. Reed. Since these plants were first released to the public in the United States in 1936, the increase in popularity has been phenomenal. The author states, "All of the dominant mutations, and probably the recessives as well, known in this country, have appeared *de novo* since 1936." Many interesting facts, concerning the raising as well as the genetics of the African violet are discussed in this article.

• **The Future Scientists of America Foundation** (of the National Science Teachers Association) **has published a booklet which lists "Materials and Services Available in 1954-55" in career guidance.** Not only is existing career guidance literature listed, but available information about scholarships, conferences, and in-training programs for both students and teachers is included. Since educators are in agreement about the urgent need for more and better trained science teachers and future scientists, this booklet should serve as a record of the presently available assistance and point to the gaps and inadequacies that exist. Orders for the booklet should be addressed to Future Scientists of America Foundation, National Science Teachers Association, 1201 16th Street, N.W., Washington 6, D.C. Price is 50¢.

• **An encouraging grant of $350,000 was made recently by the Kellogg Foundation** of Battle Creek, Michigan, **to the American Association of Agricultural College Editors** for the financing of the first five years of a "national project in agricultural communications." The project will be carried out at Michigan State College, East Lansing. Studies will be conducted on what makes a news story effective, what rural people want and need in newspaper and magazine articles and radio and television programs, and will seek to develop better written, spoken, and visual teaching aids.

• A year ago, December 2-4, 1953, a **Mid-Century Conference on Resources** was called in Washington to assemble the facts and opinions, the status and the problems about the resources of America. Sixteen hundred leaders from all parts of the country and in every field of interest gathered to share their experience and ideas. A full transcript of the conference totalled nearly 2 million words. From this and reports of the sectional chairman, an important, readable summary of the position of America's resources at the middle of the 20th century has been assembled and is now **available in book form as "The Nation Looks At Its Resources."** Four hundred and thirty-two pages long, it has been published by Resources for the Future, Inc., 1606 New Hampshire Avenue, N.W., Washington 9, D.C. for $5.00. This book will inform business men, organizations, and every citizen about the major problems we face with our resources during the next quarter of a century.

• **The American Documentation Institute honored Atherton Seidell,** one of its founders, during its annual meeting in Cleveland, November 4, 1954. Dr. Seidell was one of the first to propose the extension of library services by microfilm and worked to establish microfilm services in the U.S.D.A. Library, the Armed Forces Medical Library, the Pasteur Institute, the Faculty of Medicine of the University of Paris, and several other institutions. To assist the medical profession in locating new articles available on microfilm, Dr. Seidell, in 1941, founded the Current List of Medical Literature, which has become one of the world's great scientific indexes.

• **The Eleventh Annual Conference on Protein Metabolism,** sponsored by the Bureau of Biological Research of Rutgers University, **will be held in New Brunswick on January 28-29, 1955.** General subject of the Conference will be "Some Physiological Aspects and Consequences of Parasitism." Reports will be given on cultivation of intracellular parasites, intestinal physiology and the host-parasite relationship, protein metabolism of intracellular parasites, glycolytic enzymes of schistosomes, antibody formation, and leishmaniasis and metabolism of the host, by William Trager, Clark P. Read, James W. Moulder, Ernest Bueding, W. H. Taliaferro, and Leslie A. Stauber. The Conference is open to all registrants. Reservation blanks may be secured from Prof. William H. Cole, Rutgers University, New Brunswick, N.J.

• **The Atomic Energy Commission recently established a marine biological laboratory at Eniwetok in the Marshall Islands.** The laboratory has a twofold purpose: to serve the AEC in connection with biological studies related to atomic test activities and to make facilities available to university biologists who are interested in conducting fundamental studies. The location of the laboratory provides unusual conditions for biological studies of marine and land animals and plants of the Central Pacific area.

Eniwetok Atoll lies 2500 miles southeast of Hawaii and is made up of a circle of small coral islands approximately 20 miles in diameter. Most of the islands are covered with tropical vegetation, while others have been extensively cleared to facilitate operations during test periods. Islands and coral reefs suitable for field studies can be reached by boat and aircraft.

The laboratory, which will accommodate up to 8 to 10 investigators at any time depending upon operational requirements, is well equipped for biochemical and general laboratory procedures. Facilities for maintaining organisms in running sea water are provided. Collecting gear is available for offshore studies.

For projects which will be beneficial to the national welfare or the scientific interest of the United States, the AEC will consider sponsorship of investigations in marine biology which relate to the Central Pacific area to the following degree: for investigators with approved projects, AEC will provide laboratory space, the usual laboratory supplies, and transportation to the laboratory. Lodging and food are available at a nominal cost. Inasmuch as Eniwetok is a restricted area, AEC security clearance is required of all investigators. Inquiries should be directed to the Biology Branch, Division of Biology and Medicine, Atomic Energy Commission, Washington 25, D.C.

• **The Division of Medical Sciences, National Research Council, is accepting applications for grants-in-aid of research in three specialized fields:** (1) *The Committee on Problems of Alcohol* has available a limited fund for the support of grants. The Committee is interested in fostering research, primarily on the physiological, biochemical, and pharmacological effects of alcohol. Applications for the fiscal year 1955-56 should be postmarked not later than January 15, 1955.

(2) *The Committee for Research in Problems of Sex* is concerned with encouraging research, primarily on the mechanisms controlling sexual behavior in animals and man. Proposals involving endocrinological, neurological, psychological, anthropological, phylogenetic, and genetic studies directed toward this objective are therefore invited. Requests will also be considered that deal with the physiology of reproduction or with related biological and biochemical fields. Applications for the fiscal year 1955-56 should be postmarked on or before January 15, 1955.

(3) *The Committee on Drug Addiction and Narcotics* may have available for the coming year limited resources for the support of research in the fields of analgesia and addiction.

The Committee also invites information on basic research being carried on in these fields, in order that it may extend its activities as a center for the exchange of information on current investigations in this area.

Further details and application blanks may be obtained by writing to the appropriate committee of the Division of Medical Sciences, National Academy of Science-National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D.C.

• **Forthcoming International Congresses of interest to biologists are:**

April 12-15, 1955. Rome, Italy. *International Union of Biological Sciences*, 12th General Assembly.

April 26-May 2, 1955. Albuquerque and Socorro, New Mexico. *International Arid Lands Symposium and Conference*, Assoc. for the Advancement of Science and Southwestern and Rocky Mt. Div. of AAAS.

May 10, 1955. Mexico, D.F., Mexico. *8th World Health Assembly*, World Health Organization. Nutrition.

July, 1955. Sao Paulo, Brazil. *International Conference of the Biometric Society.*

August 1-6, 1955. Brussels, Belgium. *3rd International Congress of Biochemistry.*

August 29-September 6, 1955. The Hague, Netherlands. *14th International Horticultural Congress.*

• **The new Ninth Edition of *American Men of Science* will be published during 1955-56.** This reference work has been divided into three volumes since a single one would be unwieldy with the addition of so many new names. Volume I, ready in January 1955, will cover **The Physical Science;** Volume II, **The Biological Sciences** (probably ready Sept., 1955) and Volume III, **The Social Sciences** (ready in 1956). Further information may be obtained by writing to R. R. Bowker Co., 62 West 45th St., New York 36, N.Y., publishers.

• **Fellowships and assistantships are now available at the Baylor University Graduate Research Institute** for students wishing to work toward the M.S. or Ph.D. degrees. The Graduate Research Institute, housed in the newly constructed Wadley Research Institute and Blood Center, is located in Dallas, Texas, on the grounds of the Baylor University Hospital. Advanced degrees are being offered in those fields of science which are related to modern medicine; chemistry, bacteriology, cytology, immunology and human genetics. It is pointed out that an unusual opportunity for patient studies exists for those students interested in such work. Inquiries and applications should be directed to Dr. J. M. Hill, Baylor University Graduate Research Institute, 3600 Gaston Avenue, Dallas, Texas.

• **The Eighth Brookhaven Symposium in Biology will be held June 15-17, 1955** at Brookhaven National Laboratory, Upton, Long Island, N.Y. The symposium subject, *Mutation*, will be subdivided into six sections: (1) the chemical and physical organization of genetic material and its bearing on the mutation process, (2) genotypic modification accompanying transplantation of genetic material, (3) the reaction of genes to different mutagens; subsequent behavior of mutated genes, (4) the relation between chromosome changes and gene mutation, (5) radiation genetics, and (6) advances in the understanding of the chemistry of the mutational event. The symposium committee consists of Robert C. King, Chairman, Val W. Woodward, Arnold H. Sparrow, Marian E. Koshland, and Howard J. Curtis. U.S. Citizens interested in attending the symposium should notify the chairman by May 15, 1955. Approval from the U.S. Atomic Energy Commission is required for aliens to visit the Laboratory. For this reason aliens interested in attending the symposium should notify the chairman by May 1, 1955.

• **The first issue of *Forest Science*,** a new international journal of research and technical progress in forestry, **will appear in March 1955.** Stephen H. Spurr, University of Michigan, is chairman of the board of editors. Other members of the board are: Henry Clepper and V. L. Harper. A cooperative venture of the Society of American Foresters and other forest research and educational organizations, this quarterly will print articles on any forestry subject, but mainly those of interest to research, teaching and administrative personnel. Special preference will be given to articles discussing the results of original research. Subscription price is $6.00 per year and further information may be obtained from: Prof. Stephen H. Spurr, School of Natural Resources, University of Michigan, Ann Arbor, Mich.

• After considerable searching **a copy of Waldimir D. Selensky's "Études morphologiques et systématiques sur les Hirudinées: I. L'Organisation des Ichthyobdellides."** Petrograd. 1915. viii, 246 pp., 41 Fig., Pls. 1-8. (In Russian) **was finally located abroad.** Arrangements for a photostatic copy were made and subsequently a complete translation of the text was made. Prof. Selensky, who at the time of his death in 1931, was Head of the Parasitological Dept., University of Leningrad, U.S.S.R., was one of the leading zoologists of that country. His researches were devoted chiefly to the morphology, biology, and systematics of leeches, the most important contribution being the above publication. Museum and university libraries interested in obtaining a copy of the English translation, complete with text figures and plates, should address their inquiries to Dr. Marvin C. Meyer, Dept. of Zoology, University of Maine, Orono, Maine.

• **Ground was broken September 30** by Dean Conrad A. Elvehjem, chairman of the Biochemistry Department, **for the new wing of the University of Wisconsin Biochemistry Building.** The $1,300,000 structure will be financed by the Wisconsin Alumni Research Foundation. The new wing will be utilized exclusively for research, with one floor devoted to work in plant chemistry, another to fermentation studies, and one for research in biophysics. More than 400 doctorate degrees in biochemistry have been granted by the University of Wisconsin during the past 50 years, more than any other biochemistry department in the nation.

• **The National Science Foundation has announced 216 grants** totaling about $2,650,000 for the support of basic research in the sciences, for conferences and studies in science, exchange of information, scientific manpower, and travel of American scientists to international meetings. Biologists appearing in this list included:

Curt Stern, University of California. Structure and Function of the Posterior Processes of the Brain *Nephtys*. $6,900, 1 yr.; *Thomas Park*, University of Chicago. The Effect of Irradiation on Laboratory Populations. $3,800, 1 yr.; *Charles A. Berger*, Fordham University, N.Y. Changes in Chromosome Number During Development. $2,900, 1 yr.; *Norman D. Levine*, University of Illinois. Cultivation of Parasitic Nematodes. $9,500, 2 yrs.; *Norman E. Kemp*, University of Michigan. Utilization of Yolk in Amphibian Oogenesis. $8,100, 2 yrs.; *Ray L. Watterson*, Northwestern University. Effect of Mitotic Inhibitors on Feather Patterns. $8,000, 2 yrs.; *Wesley G. Hutchinson*, University of Pennsylvania. L Forms in *Proteus*. $11,200, 2 yrs.; *John P. Trinkhaus*, Yale University. Cell and Tissue Transformation. $12,800, 3 yrs.; *C. M. Breder, Jr.*, American Museum of Natural History. Interaction of Endocrine System. $6,800, 1 yr.; *Shelby D. Gerking*, Indiana University. Efficiency of Food Utilization by a Fish Population. $10,000, 2 yrs.; *Emery Swan*, University of New Hampshire, Environmental Effects on Growth Rate and Patterns in Sea Urchins. $5,000, 2 yrs.; *Carl Epling*, University of California. Adaptive Mechanisms in Selected Wild Populations of *Drosophila pseudoobscura*. $20,000, 3 yrs.; *Taylor Hinton*, University of California. The Role of Genes in the Metabolism of Nucleic Acid and other Compounds. $12,000, 2 yrs.; *Anton Lang* and *Sam G. Wildman*, University of California. The Mode of Synthesis and Inheritance of Protein in Plants. $21,000, 3 yrs.; *David L. Nanney*, University of Michigan. Studies of Protozoan Genetics. $21,000, 3 yrs.; *Joseph G. Gall*, University of Minnesota. Submicroscopic Morphology of the Animal Cell Nucleus. $6,000, 1 yr.; *Haig P. Papazian*, Yale University. Genetic Studies on Incompatibility Factors in *Coprinus*. $5,500, ? yrs.; *M. Delbruck*, California Institute of Technology. Photo-

tropic Responses of Sporangiophores. $15,000, 2 yrs.; *Henry Borsook* and *Richard S. Schweet*, California Institute of Technology. Metabolism of Lysine. $9,000, 2 yrs.; *Daniel E. Atkinson*, University of California. Autotrophism in *Hydrogenomonas*. $14,500, 3 yrs.; *Paul D. Saltman*, University of Southern California. Enzymatic Mechanism of CO_2 Fixation in the Succulents. $10,000, 2 yrs.; *Birgit Vennesland*, University of Chicago. Enzyme Reaction Mechanisms. $24,000, 3 yrs.; *George W. Schwert*, Duke University. Properties of Chymotrypsinogen and of Chymotrypsin. $19,000, 3 yrs.; *Earl Frieden*, Florida State University. The Properties of Ascorbic Acid Oxidase. $7,400, 2 yrs.; *Konrad Bloch*, Harvard University. Enzymatic Synthesis of Glutathione. $20,000, 3 yrs.; *Barbara W. Low*, Harvard University. X-Ray Crystal Structure of Proteins and Peptides. $10,000, 18 mos.; *F. H. Westheimer*, Harvard University. Chemical Models for Enzyme Systems. $24,000, 3 yrs.; *Ariel G. Loewy*, Haverford College. Cytoplasmic Proteins. $10,000, 2 yrs.; *S. Aronoff*, Iowa State College. Biosynthesis of Chlorophyll. $12,000, 3 yrs.; *Richard L. Hardin* and *Peter R. Moore*, University of Kentucky. Enzymes Concerned with Phosphorylation of Glycerol. $5,500, 2 yrs.; *John F. Taylor* and *Duncan Dallam*, University of Louisville. Enzymes Associated with Lipoproteins. $16,000, 2 yrs.; *Norten C. Melchoir*, Loyola University, Chicago. Molecular Structure and the Intensity of the Absorption of Light. $12,000, 3 yrs.; *John W. Hastings*, Northwestern University. Role of Flavins in Bioluminescence. $10,000, 2 yrs.; *Howard S. Mason*, University of Oregon. Biochemistry of Natural Melanins. $27,000, 3 yrs.; *A. M. Chase*, Princeton University. Mechanism of Enzyme Action: Luciferase. $9,500, 3 yrs.; *Herschel Hunt*, Purdue University. Heats of Combustion of Amino Acids and Proteins. $25,000, 3 yrs.; *Walter J. Nickerson* and *Joseph R. Merkel*. Rutgers University. Metal Regulated Reactions of Flavin Systems. $15,000, 2 yrs.; *Philip P. Cohen*, University of Wisconsin. Enzymatic Peroxidative Breakdown of Uric Acid. $24,000, 3 yrs.; *Aubrey Gorbman*, Barnard College. Comparative Physiology of Thyroidal Function. $13,000, 2 yrs.; *Edward A. Adelberg*, University of California. Enzymatic Changes in Genetic Adaptation. $26,100, 4 yrs.; *Clarence M. Agress*, University of California. Distribution and Nature of the Sensory Coronary Arterial Innervation. $12,000, 2 yrs.; *Michael Doudoroff*, University of California. Mechanisms of Utilization of Carbohydrates by Microorganisms. $26,700, 4 yrs.; *Robert B. Livingston*, University of California. Neurophysiological Mechanisms in Movement and Perception. $20,400, 2 yrs.; *Sydney C. Rittenberg*. University of Southern California. Metabolism of Malonate by *Pseudomonas fluorescens*. $24,000, 3 yrs.; *Edwin Chargaff*, Columbia University. Role of Phosphorolytic and Phosphorylating Enzymes in Nucleic Acid Metabolism. $28,600, 3 yrs.; *Philip Feigelson*, Columbia University. Adaptive Enzyme Formation in Mammals. $2,070, 6 mos.; *Donald B. Melville*, Cornell University. Biochemistry of Ergothioneine. $30,000, 3 yrs.; *Albert G. Moat*, Hahnemann Medical College & Hospital. Role of Biotin in Carbohydrate Metabolism. $8,200, 2 yrs.; *Paul L. Munson*, Harvard University. Mechanism of Stimulation of ACTH Secretion. $15,200, 2 yrs.; *Warren S. McCulloch*, Mass. Institute of Technology, Transmission of Signals Across the Central Nervous System. $25,600, 2 yrs.; *Carl Neuberg*, New York Medical College. Mechanism of Action of Certain Synthetic Hydrazine Derivatives. $15,500, 2 yrs.; *T. Z. Csaky*, University of North Carolina. Relationship Between Cellular Permeability and Carbohydrate Metabolism. $10,200, 2 yrs.; *Clayton McAuliffe*, North Carolina State College. Absorption and Metabolism of Nitrogen Compounds by the Tobacco Plant. $10,000, 2 yrs.; *James A. Liverman*, Texas Agricultural Exper. Station. Biochemistry of the Photoperiodic Response. $12,200, 2 yrs.; *Jane H. Park*, Vanderbilt University. Relation of Thyroxine to Oxidative Phosphorylation. $10,000, 2 yrs.; *Eldon H. Newcomb*, University of Wisconsin. Metabolic Changes Underlying Cell Enlargement in Plants. $14,100, 3 yrs.; *Gifford B. Pinchot*, Yale University. Phosphorylation in Cell-free Bacterial Extracts. $11,600, 2 yrs.; *Elwood C. Zimmerman*, California Academy of Sciences. Insects of Hawaii. $24,600, 2 yrs.; *Benjamin B. Leavitt*, University of Florida. Analysis of Plankton from the Deep Scattering Layer. $1,300, 1 yr.; *James E. Canright*, Indiana University. Floral Morphology and Anatomy of the Annonaceae. $5,200, 2 yrs.; *Lauren C. Gilman*, University of Miami. Morphological and Physiological Differences among Varieties of *Paramecium*. $7,100, 2 yrs.; *Pierre Dansereau*, University of Michigan. Phytosociological Studies in the Canary Islands. $1,700, 1 yr.; *Alexander H. Smith*, University of Michigan. Manual of Fleshy Basiomycetes of Western U.S. $12,400, 3 yrs.; *Rolla M. Tryon, Jr.*, Missouri Botanical Garden. A Manual of the Fern Flora of Peru. $12,100, 3 yrs.; *Preston E. Cloud, Jr.*, National Academy of Sciences. Marine Mollusks of Reefs of the Pacific Ocean. $1,950, 1 yr.; *Thomas B. Thorson*, South Dakota State College. Fluid Compartments of Fishes. $4,000, 2 yrs.; *John R. Reeder*, Yale University. Grass Embyro in Relation to Taxonomy and Phylogeny. $5,400, 2 yrs.; *R. Dohrn*, Director, Naples Zoological Station. Two American Tables at the Naples Zoological Station. $10,000, 5 yrs.; *Smithsonian Institution*, The Barro Colorado Biological Laboratory, Panama Canal Zone. $29,000, 2 yrs.

From the Societies

• **F. H. Bormann,** Dept. of Biology, Emory University, **was the 1954 recipient of the George Mercer Award** of the Ecological Society of America. The award, made annually for an outstanding paper in the field of ecology, consists of a plaque and the sum of one hundred dollars. Dr. Bormann's contribution was a paper entitled "Factors Determining the Role of Loblolly Pine and Sweet Gum in Early Old-field Succession in the Piedmont of North Carolina."

• **Two new committees were authorized by the Ecological Society of America** at its 1954 meeting in Gainesville. *A Committee for the Study of the Effects of Radioactivity on Natural Populations* was established with Orlando Park as chairman. *A Committee for the Study of Vegetation* held its organizational meeting under the leadership of John Curtis. Plans were formulated for its activities and Grant Cottam was elected chairman.

• **The 1955 meeting of the Society of American Bacteriologists will be held in New York, May 8-13.** Abstracts must be in the hands of the Program Committee not later than February 7 and should be sent to: Dr. Orville Wyss, Dept. of Bacteriology, University of Texas, Austin, Texas. Officers of the Society are: President: C. B. Van Niel; Vice-President: H. O. Halvorson; Secretary-Treasurer: J. H. Bailey, Sterling-Winthrop Research Institute, Rensselaer, N.Y.

• **At the annual meeting of the American Society for Horticultural Science** in Gainesville, September 1954, **several special awards were presented.** Recipients of these honors were: *Leonard H. Vaughan Award in Floriculture and Ornamental Horticulture:* James B. Shanks and Conrad B. Link, Dept. of Horticulture, University of Maryland, College Park, Md. *Leonard H. Vaughan Award in Vegetable Crops:* R. W. Richardson, Rockefeller Foundation, Mexico City, Mexico, and R. M. Currence, Dept. of Horticulture, University of Minnesota, St. Paul, Minn. *Joseph Harvey Gourley Award in Pomology:* J. R. Shay, Dept. of Botany and Plant Pathology, Purdue University, Lafayette, Ind., D. F. Dayton, Dept. of Horticulture, University of Illinois, Urbana, Ill., L. F. Hough, Dept. of Horticulture, Rutgers University, New Brunswick, N. J. *Alex Laurie Award in Floriculture and Ornamental Horticulture:* Charles A. Lewis, RFD 1, Fort Salonga Road, Northport, L.I., N.Y. *Charles G. Woodbury Award in Raw Products Research:* F. W. Allen, Dept. of Pomology, University of California, Davis, Calif.

• **At the 54th annual meeting of the Society of American Foresters,** held in Milwaukee, October 27, E. L. Demmon, President, presented **two of the forestry profession's highest awards.** To **William L. Hall,** Hot Springs, Arkansas, the Gifford Pinchot medal was given. Mr. Hall was co-founder, with Mr. Pinchot, of the Society and today, at eighty-one, is the oldest professional forester in active practice in America. **Thomas Gill** of Washington, D.C. was presented with the Sir William Schlich Memorial Medal. Dr. Gill, executive director of the Charles Lathrop Pack Forestry Foundation, was awarded the medal for distinguished service to international forestry.

• An award of interest to many readers was that of one of the **American Forestry Association's 1954 Distinguished Service Award to Olaus J. Murie,** president of the Wilderness Society and one of the nation's outstanding conserva-

tionists and biologists. The award was presented to Dr. Murie in a Denver hospital where he has been receiving treatment for tuberculosis-meningitis since shortly after completing the widely-publicized hike down the C & O Canal towpath with Supreme Court Justice William O. Douglas. Dr. Murie, who was nominated by 70 leaders in all phases of resources activity, has been described as "one of the most distinguished biologists since Aldo Leopold." The nation's outstanding authority on elk, Dr. Murie has long been active in the work of The American Forestry Association, Izaak Walton League, the Quetico-Superior committee and numerous other conservation groups.

Another award recipient was Palmer Hoyt, editor and publisher of the *Denver Post,* who was cited for his forceful leadership on behalf of multiple use management on public lands and support of many effective conservation measures in the West. During the annual meeting of AFA at Portland, September 6, three other distinguished leaders in conservation were presented with awards. These were: **Samuel T. Dana,** founder of the University of Michigan's School of Natural Resources; **Frederick P. Keen,** entomologist for the California Experiment Station of the Forest Service; and **Reuben B. Robertson,** chairman of the board of the Champion Paper and Fibre Company, Flat Rock, North Carolina.

• **The Southern Section of the American Society of Plant Physiologists** will meet, with the Association of Southern Agricultural Workers, at Louisville, Kentucky, February 7-9, 1955. Two symposia of special interest will be: (a) "Growth and Development with Particular References to Light and Temperature," joint with the Southern Section of the American Society of Horticultural Science, H. A. Borthwick, A. C. Leopold, James L. Liverman, J. B. Overcash, and Tokui Furuta. (b) "Plant-soil-water Relations," joint with the American Society of Agronomy, H. F. Rosene, F. M. Eaton, J. B. Page, D. E. McCloud, and V. C. Jamison.

• **The following officers have been elected to serve during 1954-55:**

American Association of Anatomists: President: Samuel R. Detwiler, Columbia University; 1st Vice President: Walter E. Sullivan, Univ. of Wisconsin; 2nd Vice President: Leon S. Stone, Yale Univ. School of Medicine; Secy.-Treas.: Normand L. Hoerr, Western Reserve University, Cleveland 6, Ohio.

American Dairy Science Association: President: L. A. Moore, Dairy Husbandry Research Branch, Beltsville, Md.; Vice President: I. A. Gould, Ohio State Univ.; Editor of *Journal of Dairy Science:* P. H. Tracy, Univ. of Illinois; Acting Secy.-Treas.: T. D. Harman, Ohio State Univ., Columbus, Ohio.

American Genetic Association: President: Ronald Bamford, Univ. of Md.; Vice Pres.: Samuel L. Emsweller, Beltsville, Md.; Treasurer: Earl L. Green, Atomic Energy Commission; Secretary: Walter E. Heston, Natl. Institutes of Health, Bethesda, Md.

American Ornithologists' Union: President: Alden H. Miller, Univ. of Calif.; 1st Vice President: Ludlow Griscom, Harvard Univ.; 2nd Vice President: Ernst Mayr, Harvard Univ.; Treasurer: Charles G. Sibley, Cornell Univ.; Editor of *The Auk:* Robert W. Storer, Univ. of Michigan; Secretary: Harold F. Mayfield, 2557 Portsmouth Avenue, Toledo, Ohio.

American Society of Human Genetics: President: C. N. Herndon, Bowman-Gray School of Medicine; Vice President: Harold Cummins, Tulane Univ. Medical School; Treasurer: W. E. Heston, National Cancer Institute; Secretary: D. C. Rife, Ohio State University, Columbus, Ohio.

Association of Southeastern Biologists: President: H. R. Totten, University of N.C.; Vice President: Fred T. Wolf, Vanderbilt Univ.; Editor of *ASB Bulletin:* Victor A. Greulach, Univ. of North Carolina; Secy.-Treas.: Mary Esther Gaulden, Oak Ridge Natl. Laboratory, Oak Ridge, Tenn.

American Society of Limnology and Oceanography: President: Thurlow Nelson, Rutgers Univ.; Vice President: William E. Ricker, Pacific Biological Station, Nanaimo, Canada; Secy.-Treas.: Bostwick H. Ketchum, Woods Hole Oceanographic Institution, Woods Hole, Mass.

Potato Association of America: President: Arthur Hawkins, Univ. of Conn.; Vice President: C. W. Frutchey, Fort Collins, Colo.; Treasurer: J. C. Campbell, New Brunswick, N.J.; Secretary: R. W. Hougas, Univ. of Wisconsin, Madison, Wis.

Society of American Foresters: President: Elwood L. Demmon, Southeastern Forest Experiment Station, Asheville, N.C.; Vice President: DeWitt Nelson, Dept. of Natural Resources, Sacramento, Cal.; Exec. Secy.: Henry Clepper, Mills Building, Washington, D.C.

Society for Industrial Microbiology: President: James G. Horsfall, Connecticut Agricultural Experiment Station; Vice President: H. B. Woodruff, Merck & Co.; Secretary: C. L. Porter, Purdue Univ., West Lafayette, Ind.

Society for the Study of Evolution: President: Sewall Wright, University of Chicago; Vice President: Jens Clausen, Carnegie Institution, Stanford, Cal.; Treasurer: W. Frank Blair, Univ. of Texas; Secretary: Harlan Lewis, Dept. of Botany, Univ. of Calif., Los Angeles, Calif.

American Bryological Society: President: Winona H. Welch, DePauw Univ.; Vice President: Ruth Schornherst Breen, Florida State Univ.; Secy.-Treas.: L. J. Gier, William Jewell College, Liberty, Mo.

American Physiological Society: President: Hiram E. Essex, Mayo Clinic, Rochester, Minn.; Secy.-Treas.: W. F. Hamilton, Medical College of Georgia, Augusta, Ga.; Executive Secretary: Milton O. Lee, 9650 Wisconsin Ave., N.W., Washington 14, D.C.

American Society of Ichthyologists and Herpetologists: President: Edward C. Raney, Cornell University; Vice President: *Conservation:* Robert C. Stebbins, University of Calif., *Finance:* L. M. Klauber, 233 W. Juniper St., San Diego, Cal., *Membership:* Ernest A. Lachner, U.S. National Museum; Treasurer: Coleman J. Goin, Univ. of Florida; Secretary: Arnold B. Grobman, Florida State Museum, Gainesville, Florida.

American Society of Naturalists: President: Kenneth V. Thimann, Harvard University; Vice President: Elmer G. Butler, Princeton University; Treasurer: Carl P. Swanson, Johns Hopkins Univ.; Secretary: Warren P. Spencer, Wooster College, Wooster, Ohio.

American Society of Parasitologists: President: Clay G. Huff, Naval Medical Center, Bethesda, Md.; Vice President: Gilbert F. Otto, Abbott Labs., North Chicago, Ill.; Treasurer: Robert M. Stabler, Colorado College; Editor: *Journal of Parasitology:* George R. LaRue, Animal Research Center, Beltsville, Md.; Secretary: Arthur C. Walton, Dept. of Biology, Knox College, Galesburg, Ill.

Ecological Society of America: President: Wm. J. Hamilton, Jr., Cornell Univ.; Vice President: Murray F. Buell, Rutgers Univ.; Treasurer: Alexander C. Hodson, Univ. of Minnesota; Secretary: John R. Reed, Dept. of Botany, University of Wyoming, Laramie, Wyo.

Genetics Society of America: President: Paul C. Mangelsdorf, Harvard University; Vice President: Ralph E. Cleland, Indiana Univ.; Treasurer: N. H. Giles, Jr., Yale University; Secretary: Clarence P. Oliver, Experimental Science Bldg. 120, University of Texas, Austin 12, Texas.

Mycological Society of America: President: William W. Diehl, Plant Industry Station, Beltsville, Md.; Vice President: Josiah L. Lowe, Syracuse Univ.; President-Elect: Ralph Emerson, Univ. of California; Act. Secy.-Treas.: Everett S. Beneke, Botany & Plant Pathology Dept., Michigan State College, East Lansing, Mich.

Poultry Science Association: President: O. E. Goff, Univ. of Tennessee; 1st Vice President: J. H. Quisenberry, Texas

A & M College; 2nd Vice President: T. B. Avery, Kansas State College; Secy.-Treas.: C. B. Ryan, Box 2211, College Sta., Texas.

Society of General Physiologists: President: Frank A. Brown, Jr., Northwestern University; Vice President: C. Stacy French, Carnegie Institution of Washington, Stanford, Calif.; Secy.-Treas.: John Buck, Laboratory of Physical Biology, Natl. Institutes of Health, Bethesda, Md.

Society for the Study of Development and Growth: President: Victor C. Twitty, Stanford Univ.; Treasurer: Robert W. Briggs, Lankenau Hosp. Research Institute, Philadelphia, Pa.; Secretary: M. V. Edds, Jr., Brown University, Providence 12, R.I.

Officers of several other societies appeared in the October 1954 issue.

• **The annual 1954 meeting of the Society of General Physiologists** was held at the Marine Biological Laboratory, Woods Hole, Mass., on September 8-9, with 90 registrants. The first day was devoted to a symposium on "Electrolytes in Biological Systems", dedicated to W. J. V. Osterhout and M. H. Jacobs. Abstracts of the Symposium papers and of the 19 short research papers given on the second day, will appear in the *Journal of Cellular and Comparative Physiology*. At the business meeting officers for 1954-55 were announced (see column above). The meeting closed with a notable social hour at the L. V. Heilbrunn estate.

From the Editor

IN the October 1954 issue of the *Bulletin*, Dr. H. Bentley Glass in "A Letter to all Biologists" announced that the Governing Board of AIBS has made a momentous decision—that of becoming independent of the National Research Council, within which AIBS has been nurtured since its birth in 1948. He added that "as soon as three-fifths of the member societies have ratified this action it will be effected."

Approval of 11 of the 18 member societies was required to ratify; at this writing 13 member societies have voted on this question—all for independence. Therefore, AIBS is now independent of NRC in spirit, if not in fact. The NRC has generously permitted AIBS to continue to use its facilities for a limited time while AIBS is becoming incorporated and taking other actions necessary for independent operation.

The new categories of individual membership recommended by the Governing Board and described in the October issue of the *Bulletin* have since been approved by three-fifths of the member societies. Applications for individual memberships are now receivable (please use the form on page 25). If AIBS is supported by biologists as it can and should be, it will survive and grow strong and its strength will be a measure of the solidarity and influence of biology in the United States.

Your editor will serve as part-time editor and executive secretary of AIBS only until his full-time successor is chosen—perhaps before the next issue of the *Bulletin* appears. Given increasing support, the next editor-executive secretary cannot fail to make progress. For as long as may be desirable he will have the help and advice of those, including the writer, who have worked for AIBS, i.e., C. J. Hylander, M. O. Lee, S. L. Meyer, H. B. Steinbach, and R. L. Zwemer. He will also have the active support of a revitalized Editorial Board of the *Bulletin* consisting of Ronald Bamford, chairman, R. E. Cleland, E. J. Farris, D. G. Hall, Boyd Harshbarger, and C. J. Hylander—all men of experience in biological publications and public relations.

The further development of the *Bulletin* to increase its usefulness to the members of AIBS and to provide a sense of solidarity and community of interest, should be given the highest priority. In this, his last communication to the members of AIBS, the writer wishes them to know about the editorial services performed during the past year by Mrs. Ileen Stewart. She deserves the highest praise not only for maintaining and improving the textual content of the *Bulletin*, writing the columns and most of the book reviews, but for servicing and building up advertising as well.

We are most concerned, at the moment, about the role of the *Bulletin* as a medium for the expression of opinion of individual biologists or groups of biologists. We have no doubt that the *Bulletin* ought to publish the views of its members insofar as space permits. At present mere limitation of space will exclude the longer articles of opinion that in our judgment are not of general interest to the readers of the bulletin. We should like to encourage submission of short letters to the editor or brief reports of conclusions reached from surveys or conferences on problems of interest to all biologists; we wish to discourage submission of manuscripts giving *details* of surveys and conferences, particularly those that deal with a *segment* of biology rather than the whole.

We hope that the next editor will be sensitive to inequities affecting biologists and will express himself on any such that come to his attention. For example, we are told that commissioned officers holding the degrees of M.D., D.D.S., or D.V.M. are entitled by law to higher compensation than a Ph.D. officer doing the same work. It is even possible for a supervisor to be paid less than one whom he supervises. Congress has simply offered a bonus to the holders of certain degrees, believing it necessary as an inducement to commissioned service. One may argue either that Ph.D.'s should get the same bonus, or that there should be no special favors for the holders of advanced degrees. We favor a review of the situation and restoration of equality. We believe that degrees should have no *legal* relation to income.

The foregoing expression of opinion is that of your editor and does not necessarily represent the opinion of the majority of the members of AIBS on the question. However, we would appreciate hearing, by letter, from those biologists who feel this matter is an important one.

Letters to the Editor

I've just completed reading the October issue of the *Bulletin*. As usual it has been a pleasant and informative experience and I'd hate to think that it might not continue to come my way. For us biologists, there isn't anything like it.

We biologists need something to hold us together. Surely there are others like myself who for one reason or other are no longer working in our chosen fields yet who want to know what is going on and who's doing what. Biologists never have been a closely integrated group and from a business man's viewpoint they tend to operate on a shoestring. Perhaps the finances of chemical organizations are sounder because of the closer affiliation of chemists with industry and business. Or is it that a larger percentage of biologists are the offspring of clergymen, who have been admonished to "take no thought of the morrow"?

A. Dorothy Bergner,
October 29, 1954 3204 N. Calvert St., Baltimore, Md.

The A.I.B.S. Reports

• Within the last few weeks approximately **10,000 biologists have received questionnaires, mailed from the AIBS office, for registration in the National Scientific Register.** Members of the following societies were included in this mailing: Biometric Society, Amer. Soc. of Animal Production, Phycological Soc. of America, Society of Systematic Zoology, Wildlife Society, Entomological Society of America, Amer. Soc. of Range Management, Amer. Soc. of Mammologists, Society of Protozoologists, Amer. Soc. of Parasitologists, National Assoc. of Biology Teachers. It is hoped that all who received questionnaires will complete and return them promptly so the Register may be completed during 1955.

• At a Board Meeting of the **Institute of Animal Resources** held November 22, Dr. Dale Jenkins, Camp Detrick, Frederick, Maryland, was named Chairman, replacing Dr. T. C. Byerly, U.S. Dept. of Agriculture who has been serving as temporary chairman. At this meeting the recent *Handbook of Laboratory Animals* was discussed and plans made for a future issue to appear about mid-summer 1955. The approximate numbers of animals of all species used in research in 1953 in 96 institutions which reported numbers, amounted to 4.5 million. Mice accounted for about 75 percent of the laboratory animals used, followed by rats (11.5 percent) and guinea pigs, hamsters, and chicks (each slightly over 3 percent). The remainder (about 5 percent) was scattered among a wide variety of animals. The survey of laboratory animal producers and users begun last year is to be continued until more complete and accurate data can be accumulated.

• **The Advisory Committee in Physiological Psychology** to the Office of Naval Research, under the Chairmanship of Dr. Carl Pfaffmann, met in Washington, D.C., on October 14, 1954. Existing contracts in the Physiological Psychology Branch were discussed together with the evaluation of new proposals. Dr. Henry A. Imus, Head of the Physiological Psychology Branch of the ONR announced that he would be replaced by Dr. Richard Trumbull as of October 18th. Dr. Imus has accepted an appointment with the National Institute of Neurological Diseases and Blindness of the National Institutes of Health.

• On November 1, 1954, **the Advisory Committee in Biochemistry** to the Office of Naval Research, met in Urbana, Illinois, to evaluate on their scientific merits nearly 30 new proposals and currently existing projects. The Committee is under the Chairmanship of Dr. Severo Ochoa.

• **The Advisory Committee in Physiology** to the Office of Naval Research met in Urbana, Illinois, on November 12 to review a number of new proposals on the basis of scientific merit. This Committee is under the Chairmanship of Dr. Joseph Lilienthal, of the Johns Hopkins University School of Medicine.

The January list of registrants in the AIBS Placement Service may be obtained by employers after January 15th, for $1.00 per copy, by writing to Placement Service, American Institute of Biological Sciences, 2101 Constitution Avenue, Washington 25, D.C. Over 125 registrants appear in this current list.

The Biology Library

One copy of each publication submitted for listing should be sent to the Editor, The AIBS Bulletin, 2101 Constitution Avenue, Washington, D. C. Only books published within a year of receipt will be reviewed. Older books will be listed.

ANIMAL SCIENCES

Animal Cytology and Evolution. M. J. D. WHITE. 454 pp., 147 illus. Cambridge University Press, 32 East 57th St., New York 22, N.Y. (2nd edition, 1954) $8.50.

Originally published in 1945, this second edition has been completely rewritten to include all of the recent important advances in animal cytogenetics and related fields. The chapter on chromosomal evolution in *Drosophila* has been eliminated and the material distributed, where appropriate, in other chapters. New Chapters on "Polyploidy in Animals" and "Chromosomal Rearrangements and Speciation" have been added. There are 53 new illustrations; the already extensive bibliography has been broadened and should serve as a valuable guide to the literature in the field.

The Natural Regulation of Animal Numbers. DAVID LACK. 343 pp., 52 fig. Oxford University Press, 114 Fifth Ave., New York 11, N.Y. (1954) $5.60.

The author writes, "Most wild animals fluctuate irregularly in numbers between limits that are extremely restricted compared with what their rates of increase would allow. There has been much dispute concerning both the nature of this restriction and the factors which bring it about. This book is an attempt at a fresh approach. It is not a textbook repeating what is well established, but a venture into the obscure, a survey of recently discovered facts and a synthesis which includes new ideas." A large part of the discussion is based on birds, because more is known about them and ornithology is the author's special area of research. Each problem, however, is considered for mammals, fish, insects, and other animals. Microorganisms and plants have been omitted. Dr. Lack is Director of the Edward Grey Institute of Field Ornithology at Oxford University, England.

The Physiology of Insect Metamorphosis. V. B. WIGGLESWORTH. 152 pp., illustrated. Cambridge University Press, 32 East 57th St., New York 22, N.Y. (1954) $2.50

In an effort to provide current information in the various branches of biology, Cambridge University Press has begun publication of a series, "Cambridge Monographs in Experimental Biology." Each monograph will be limited to about 40,000 words, published quickly and be in the nature of a minor treatise. *The Physiology of Insect Metamorphosis* is the first such monograph to appear. In it Professor Wigglesworth develops the argument that metamorphosis is to be regarded simply as a particularly striking example of polymorphism, which is universal among animals. Chapter headings are: Introduction, Histological Changes During Moulting and Metamorphosis, Physiology of Growth and Moulting, Physiology of Metamorphosis, and Differentiation and Polymorphism. The small volume is amply illustrated and supplied with a thorough bibliography.

The Genetics of Paramecium Aurelia. G. H. BEALE. 179 pp., illustrated. Cambridge University Press, 32 East 57th Street, New York 22, N.Y. (1954) $2.50.

Volume II in the Cambridge Monographs in Experimental Biology summarizes the experimental work to date in paramecium genetics. Dr. Beale emphasizes the more recent work but presents a general introduction to the subject for the benefit of biologists who are not specialists in the field. He believes that the study of paramecia may radically change the present relationship between genetics and biology as a whole and be the means of supplying several important fundamentals. For further or more detailed reading on the subject, the author supplies an excellent bibliography and refers to several papers which deal with earlier literature as well as to the last review (Sonneborn, 1947) of the situation.

Amphibians and Reptiles of Western North America. ROBERT C. STEBBINS. 528 pp., 52 fig., 104 pl. McGraw-Hill Book Company, 330 West 42nd St., New York 36, N.Y. (1954) $8.50.

There has long been a need for a book such as this. Although regional in nature, it incorporates in one volume the means of identification of the majority of species of salamanders, frogs and toads, turtles, lizards and snakes. A two-column format seems to make reading easier and the author's excellent drawings aid materially in identification. A detailed distribution map accompanies each species and with these maps are annotations about subspecies, altitudinal range, and isolated occurrences. For amateur naturalists or herpetologists there is a section devoted to collecting and preserving specimens, techniques of tracking, shooting and trapping various species, and equipment. The book is eminently readable, by layman or professional, and should become the definitive work in the field. Dr. Stebbins is Associate Professor of Zoology and Curator of Herpetology at the Museum of Vertebrate Zoology, University of California, Berkeley.

Mammals of California and Its Coastal Waters. LLOYD G. INGLES. 396 pp., 95 fig., 46 pl. Stanford University Press, Stanford, California. (2nd edition, 1954) $6.00.

Not only students of California, but zoologists everywhere should find Dr. Ingles' new edition of "Mammals of California" interesting as well as informative. The text material is lucid and engrossing and the illustrations excellent. The author has contributed scores of original photographs and H. Wayne Trimm's paintings of the animals in the pictorial keys are not only scientifically accurate, but artistically of much merit. Orders included are: Marsupialia, Insectivora, Chiroptera, Carnivora (Fissipedia), Carnivora (Pinnipedia), Rodentia, Lagomorpha, Perissodactyla, Artiodactyla, and Cetacea. An appendix offers sections on: how to collect and prepare skins, dental formulae, a key based on skulls, identification by means of scats, pronunciation of names, a check list of native and introduced species, and the principles of zoological classification. Dr. Ingles is Professor of Zoology and Head of the Life Science Division of Fresno State College, California.

Wildlife Management. Vol. II. Fur Bearers, Waterfowl and Fish. REUBEN E. TRIPPENSEE. 572 pp., illustrated. McGraw-Hill Book Company, 330 West 42nd St., New York 36, N.Y. (1953) $7.50.

The first in this two-volume series, *Wildlife Management: Upland Game and General Principles,* appeared in 1948. This second and final volume of the study is concerned with the management of water and wet lands, and the life histories, ecology, and management of fur bearing animals, waterfowl, and freshwater game fish. The rather new concepts of wild game management are included as well as comments by leaders in fish and game management. Using standard subject headings each game animal received the following attention: fur facts, life history, geographic distribution, anatomy, ecology, and management. Waterfowl are discussed according to habitat as are game fish—cold and warm water. Illustrations are largely photographic and good; line drawings, by several artists, include, in particular, excellent reproductions of wildfowl and several flyway maps.

PLANT SCIENCES

The Pruning Manual. EVERETT P. CHRISTOPHER. 320 pp., 53 fig., 12 pl. The MacMillan Company, 60 Fifth Ave., New York 11, N.Y. (1954) $5.00.

For over fifty years *The Pruning Manual* by Liberty Hyde Bailey has been the standard reference in this field. Written by Dr. Bailey, who died December, 1954, when he was a student, the volume has been in need for revision of some time. Dr. Everett Christopher recently undertook the preparation of an up-to-date successor and the result is worthy of the Bailey tradition. The author presents the basic anatomical and physiological principles involved in plant growth as related to pruning as well as specific instructions for the pruning of all temperate zone fruits, shade trees, and ornamental shrubs. Directions are simple, concise and sufficiently detailed to be used by amateurs as well as professionals. Illustrations are plentiful and should be very helpful to the practitioner. Dr. Christopher is Head of the Dept. of Horticulture and Vice-Dean of Agriculture at the University of Rhode Island.

Plant Regulators in Agriculture. Edited by H. B. TUKEY. 269 pp., illustrated. John Wiley & Sons, 440 Fourth Ave., New York 16, N.Y. (1954) $5.50.

The editor's preface states, "This book is prepared for the many who have been puzzled and even annoyed at their seeming inability to grasp the significance of plant regulators, what they are, how they operate, and where they belong in agriculture. The fault is not theirs. It is really nobody's fault. It is simply that the science of plant regulators was born so suddenly and has grown so rapidly that the child of today is scarcely recognized by his own parents as the one they knew of yesterday." The sixteen chapters have been prepared by specialists who cover the elementary facts and principles as well as applied topics. Special treatment is given to plant regulators in propagation, fruit set, blossom thinning, pre-harvest drop, plant breeding, fruit ripening, sprout inhibition, weed control in farm crops, ornamentals, lawns, small fruits, rights of way, and equipment and instructions for applications. The editor adds an encouraging word, "Any person who masters the material (in this book) in its entirety will have a good understanding of plant regulators and may feel well informed in the field."

The Plant Quarantine Problem. W. A. McCUBBIN. 455 pp. Ejnar Munksgaard, 6 Norregade, Copenhagen, Denmark, & Chronica Botanica Co., Waltham 54, Mass. (1954) $4.80.

This book is Volume XI of Annales Cryptogamici et Phytopathologici, edited by Frans Verdoorn and published in Denmark. The author, until his retirement in 1950, served for twenty years in the U.S. Bureau of Entomology and Plant Quarantine, as adviser in plant disease problems. Although much has been written about individual phases of the plant quarantine problem, Mr. McCubbin believes this is the first attempt to present the subject as a composite whole in the form of an overall review. The book was written, not for the men who work on plant quarantine problems, but for the teacher, scientific worker, agricultural and community leader, writer, editor, and citizen who have not had time or opportunity to study this field but who are often called upon to give interpretations or appraisals.

Advances in Agronomy. Volume VI. Edited by A. G. NORMAN. 383 pp., illustrated. Academic Press, Inc., 125 East 23rd St., New York 10, N.Y. (1954) $8.00.

The editor writes, "This volume follows the general pattern of its predecessors. In view of the attention now centered in the provision of aid and advice in the improvement of agricultural practices in less developed countries, the article by Harrar is particularly pertinent. In it he recounts the principles which have been followed by the Rockefeller Foundation in their highly successful programs in Central America. On the domestic scene, Savage and McIlvain review the great changes that have been brought about in range improvement as a result of the application of basic agronomic principles to range problems. Wilsie and Shaw take a broad viewpoint and discuss the adaptation of crops to environment and the influence of climatic factors on problem of crop production. Their examples are mostly taken from North American experience, but the information summarized is an example of that currency that is international." Nine papers, written by seventeen authors, appear in this Volume.

Planting the Southern Pines. PHILIP C. WAKELEY. 233 pp., illustrated. Agricultural Monograph No. 18, Forest Service. U.S. Dept. of Agriculture. Obtainable from Superintendent of Documents, Government Printing Office, Washington 25, D.C. (1954) $2.75.

A very thorough manual, *Planting of Southern Pines*, includes sections on: planting policies, seed, nursery practice, planting, and plantation care. An appendix offers discussions of insecticides, fungicides, plant quarantine, germination tests, seedling inventories, directions for types of planting, and control of pests in plantations and nurseries. The A, B, C's of pine forestry in the south are clearly presented and adequately illustrated in this volume.

MISCELLANEOUS

Recent Progress in Hormone Research. Vol. X. Edited by GREGORY PINCUS. 511 pp., illustrated. Academic Press, Inc., 125 East 23rd St., New York 10, N.Y. (1954) $9.80.

This volume offers the Proceedings of the 10th annual Laurentian Hormone Conference, held in September 1953 at Mont Tremblant, Quebec. It includes fourteen complete papers and the discussions that followed each. Individual papers include: The Central Nervous System and Stress-Induced Eosinopenia, Studies of Brain Metabolism and Electrical Activity in Relation to Adrenocortical Physiology, Effects of Hormones on Brain Excitability and Electrolytes, Triiodothyronine in Relation to Thyroid Physiology, Metabolic Effects of Thyroid Hormones *in Vitro*, Endocrine Mechanisms in the Life of Insects, Hormones Produced by Neurosecretary Cells, The Preparation and Chemistry of Crystallin Insulin, The Chemistry of the Corticotrophins, Endocrine Factors and Radiation-Induced Lymphoid Tumors of Mice, Endocrine Influences Upon the Formed Elements of Blood and Blood-Forming Organs, Some Problems Related to Ovarian Function and to Pregnancy, Clinical Studies on Electrolytes and Fluid Metabolism, A Comparison of Steriodal Excretion and Metabolic Effects Induced in Man by Stress and by ACTH.

International Review of Cytology. Volume III. Edited by G. H. BOURNE and J. F. DANIELLI. 530 pp., illustrated. Academic Press, Inc., 125 East 23rd St., New York 10, N.Y. (1954) $9.50.

Third in the series of Reviews of Cytology, prepared under the auspices of The International Society of Cell Biology, this volume contains 13 papers, by authors from seven countries. Titles include: The Nutrition of Animal Cells, Caryometric Studies of Tissue Cultures, The Properties of Urethan Considered in Relation to Its Action on Mitosis, Composition and Structure of Giant Chromosomes, How Many Chromosomes in Mammalian Somatic Cells?, The Significance of Enzyme Studies on Isolated Cell Nuclei, The Use of Differential Centrifugation in the Study of Tissue Enzymes, Enzymatic Aspects of Embryonic Differentiation, Azo Dye Methods in Enzyme Histochemistry, Microscopic Studies in Living Mammals with Transparent Chamber Methods, The Mast Cell, Elastic Tissue, and The Composition of the Nerve Cell Studied with New Methods.

An Outline of Developmental Physiology. CHR. P. RAVEN. 216 pp., 64 fig., 10 pl. McGraw-Hill Book Company, 330 West 42nd St., New York 36, N.Y. (1954) $5.50 (Translated by L. De Ruiter).

Translated from the Dutch edition, published in 1948, this little book is meant for readers, interested in the subject of embryology, who have some general knowledge of science, but are not acquainted with more than the first elements of biology. This does not mean that the book is a popularization of embryological events for it has been widely used as an introduction to the field by medical and biology students and secondary school teachers. For the benefit of the non-biologists a glossary of terms has been included, and a bibliography guides the interested reader to the source of original publications. The author is Professor of Zoology at the University of Utrecht.

Streams, Lakes, Ponds. ROBERT E. COKER. 327 pp., 25 pl., 28 fig. University of North Carolina Press, Chapel Hill, N.C. (1954) $6.00.

Anyone interested in inland waters and the life in them should find this book interesting. Part I describes water and all its properties, the effects of light and heat, the chemical and biological relations of gases, stratification, and turbidity. The second part deals with running water, as brooks or rivers, and the subject of stream pollution. Part III, concerned with still water, discusses the plant and animal life of lakes, the inhabitants of fish ponds and their productivity. The author is Kenan Professor of Zoology at the University of North Carolina and previously published a marine biology book, *This Great and Wide Sea*.

Chemical Specificity in Biological Interactions. Edited by FRANK R. N. GURD. 234 pp. Academic Press Inc., 125 East 23rd St., New York 10, N.Y. (1954) $6.00.

Volume III in the Memoirs of the University Laboratory of Physical Chemistry, of Harvard University, contains the symposium papers of 13 authors, including the late Edwin J. Cohn. Subjects and authors are: Chemical Specificity of Biological Interactions, E. J. Cohn; The Effects of X-ray and other Radiation on Proteins and Living Tissues, Shields Warren; Physical and Chemical Properties of the Steroids Relating to Protein Binding, R. B. Turner; Biochemical Problems of the Steroid Hormones, T. F. Gallagher; Some Studies on the Active Principles of the Posterior Pituitary Gland, V. Du Vigneaud; The Influence of Ion-exchange Chromatography upon Our Concept of the Structure of Ribonucleic Acid, Waldo E. Cohn; Special Problems in the Formation of Metal Complexes, C. D. Coryell; Interactions of Metals with Small Molecules in Relation to Metal-protein Complexes, Jack Schubert; The Specificity of Metal Complex Formation, Gerold Schwarzenbach; The Interaction of Proteins with Small Molecules and Ions, George Scatchard, Walter L. Hughes, Jr., F. R. N. Gurd, and Philip E. Wilcox.

The Biochemistry of Semen. T. MANN. 240 pp., 7 pl., 16 fig., John Wiley & Sons, 440 Fourth Avenue, New York 16, N.Y. (1954) $2.90.

One of the Methuen Monographs on Biochemical Subjects, printed in Great Britain, this small volume packs in a large amount of up-to-date information on a subject that is relatively modern. The author is Reader in Physiology of Animal Reproduction at the University of Cambridge. The book was written because the author, and others in this field of research, found it very difficult to gather together the widely-scattered literature on the subject. Dr. Mann would

like to have the book considered as an Interim Report, because this field of research is in such a fluid state of development. An extensive bibliography lists the available literature.

Elements of Ecology. GEORGE L. CLARKE. 534 pp., illustrated. John Wiley & Sons, 440 Fourth Ave., New York 16, N.Y. (1954) $7.50.

Dr. Clarke, Associate Professor of Zoology at Harvard, states in the preface to this book, "The purpose of this book is to bring together in one place and in a simple way the elements of ecology with special emphasis on the modern viewpoint of the science. It is desired to stress the unity of ecology and the necessity for including the influence of both plants and animals as well as the physical forces as part of the environment." The book is primarily for students in ecology but can well serve as background material for those in conservation, forestry, agriculture, fisheries, wildlife management, and other branches of applied ecology. The general biology student could also read the book with profit since many ecological principles serve as a background for work in physiology, morphology, genetics, and evolution. The book is amply illustrated, concisely written and well supplied with bibliographic reference for the student who would read further.

The Language of Taxonomy. JOHN R. GREGG. 70 pp. Columbia University Press, 2960 Broadway, New York 27, N.Y. (1954) $2.50.

This small volume is one of the scientific contributions to the Columbia Bicentennial Editions and Studies. Dr. Gregg discusses the differences between taxonomy proper and methodological taxonomy and proceeds to apply symbolic logic to the study of classificatory systems. The attention of readers is drawn to *set-theory* which lies between elementary logic and elementary mathematics and provides systematization for ideas centering around the notion of set, class, aggregate, or collection and is therefore, ideally applicable to taxonomy. Using set-theory, the author reconstructs a neo-Linnaean concept of the taxonomic system. The book will doubtless appeal to all in systematics and stimulate many other biologists.

The Vitamins. Volume III. Edited by W. H. SEBRELL, JR. and ROBT. S. HARRIS. Academic Press, Inc., 125 East 23rd St., New York 10, N.Y. (1954) $15.00.

This volume continues the excellent series that will eventually supply complete coverage on vitamins. Volume III contains the following contributors and subjects: *p-Aminobenzoic Acid*, R. S. Harris, L. D. Wright, P. A. Tavormina, H. M. Wuest, and C. C. Scott; *Pteroylglutamic Acid*, E. L. R. Stokstad, R. S. Harris, and F. H. Bethell; *Pyridoxine and Related Compounds*, R. S. Harris, J. C. Kereztesy, W. W. Umbreit, H. Sherman, E. E. Snell, C. S. Keevil, Jr., P. György, and K. R. Unna; *Riboflavin*, R. S. Harris, T. Wagner-Jauregg, M. K. Horwitt, D. M. Hegsted, and E. E. Snell; *Thiamine*, R. S. Harris, B. C. P. Jansen, H. M. Wuest, K. R. Unna, and W. H. Sebrell, Jr.; *The Tocopherols*, R. S. Harris, H. A. Mattill, P. L. Harris, and K. E. Mason; *New and Unidentified Growth Factors*, Vernon H. Cheldelin. Each chapter contains sections on: nomenclature, chemistry, industrial preparation, biochemical systems, specificity of action, biogenesis, estimation, standardization of activity occurrence in food, effects of deficiency, pharmacology, and requirements and factors influencing them.

Isotopic Gas Analysis for Biochemists. F. R. GLASCOCK. 247 pp., illustrated. Academic Press, Inc., 125 East 23rd St., New York 10, N.Y. (1954) $5.80.

The author is Head of the Isotope Section of the National Institute for Research in Dairying, at the University of Reading, England. The book is essentially a laboratory manual, which Dr. Glascock feels timely since the gas phase measurement of carbon and hydrogen isotopes has aroused considerable interest among biochemists and the literature has become quite extensive. The author has drawn from his own experience in directing an extensive program in this field and added other techniques from literature.

A Manual of Tropical Medicine. THOMAS T. MACHIE, GEORGE W. HUNTER, III, and C. BROOKE WORTH. 907 pp., 304 illustrations. W. B. Saunders Company, West Washington Square, Philadelphia 5, Pa. (2nd edition, 1954) $12.00.

The first edition of this book was published during World War II to meet the needs of the Armed Forces in the tropics. Since that time events have been focusing attention on regions of the world where tropical diseases are a factor in the well-being of the inhabitants. Constructive research in the fields of tropical medicine, public health, and epidemiology has been undertaken and great progress made. This new information rendered the first edition obsolete and made the preparation of a revised edition imperative. Twenty-four collaborators have contributed to various chapters. New chapters on encephalitides, trachoma, rickettsialpox, trench fever, leptospiral diseases, leprosy, toxoplasmosis, gnathostomiasis, trichostrongyliasis, and nutritional diseases, effects of heat, epidemic hemorrhagic fever, and medically important molluscs have been added or substituted. Illustrations, as before, are plentiful and good.

Science Reasoning and Understanding. PAUL L. DRESSEL and LEWIS B. MAYHEW. 223 pp., illustrated. Wm. C. Brown Co., Dubuque, Iowa. (1954) $3.50.

This is an interesting manual that is worth a perusal by all engaged in teaching science in colleges and universities. It was prepared by the Intercollege Committee on the Evaluation of Science Objectives (of the Cooperative Study of Evaluation in General Education) composed of active teachers from seventeen institutions and two consulting-evaluation specialists. This committee, on teaching science to non-science majors considered three objectives: to develop students who could (1) apply science knowledge to new problems and situations, (2) read and evaluate news articles and popular writings on scientific developments, and (3) to understand the point of view with which a scientist approaches his problem. Using excerpts from newspapers, magazines, and books and several articles from *Scientific American*, this manual builds exercises and problems that develop scientific reasoning and better student understanding of modern day research.

Glutathione. A Symposium. Edited by S. COLOWICK, A. LAZAROW, E. RACKER, D. R. SCHWARTZ, E. STADTMAN, and H. WAELSCH. 341 pp., illustrated. Academic Press, Inc., 125 East 23rd St., New York 10, N.Y. (1954) $7.50.

In the thirty years since glutathione was discovered, it has been considered largely as an unspecific component of redox systems. In the last five years, however, specific functions of this widely occurring sulfhydryl tripeptide in peptide synthesis and oxidative processes have been revealed. Recent investigations have also emphasized the importance of glutathione in radiation damage, diabetes, and other metabolic disturbances. This book contains the papers presented at a symposium held in November 1953, in Ridgefield, Connecticut, and supported by the National Science Foundation and the Office of Naval Research. The symposium was organized to undertake a critical review of the literature and evaluate the present status of knowledge about glutathione. Discussions as well as the formal papers are included.

Fluoridation as a Public Health Measure. Edited by JAMES H. SHAW. 232 pp. American Association for the Advancement of Science, 1515 Massachusetts Avenue, Washington 5, D.C. (1954) $4.50 ($4.00 to AAAS Members).

Since the subject of fluoridation is an important national and regional issue at the present time, the contents of this book should be of interest to many people. This represents the third monograph on the subject published by AAAS. The first of the series, *Fluorine and Dental Health*, appeared in 1941, and the second, *Dental Caries and Fluorine*, in 1944. The current monograph represents the accumulated results of two symposia, presented during the 1951 and 1952 AAAS meetings. To the revised manuscripts from these symposia have been added four other manuscripts, filling the gaps in the study. The result is a rather complete evaluation of the present knowledge of the relation of fluoride ingestion to human health.

Scientific and Technical Serial Publication. Soviet Union. 1945-53. 118 pp., Science Division, Library of Congress. Obtainable from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. (1954) $0.60.

This is a special supplement to the monthly list of Russian accessions of the Library of Congress and was prepared by the Science Periodical Unit through a grant from the National Science Foundation. The references, each with a brief notation about content, are listed under: physical sciences, life sciences, agriculture, medicine, and engineering and technology.

Scientific and Technical Serial Publications. United States, 1950-53. Science Division Library of Congress. 238 pp. Obtainable from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. (1954) $1.25.

A comprehensive list that is divided into: Part I, Periodical, Annuals, Series, and Society Publications (Non-Government); and Part II, Publications of Federal, State and Local Governments, it includes subject headings: physical sciences, life sciences, agriculture, medicine, and engineering and technology.

Electrometric pH Determinations. Theory and Practice. ROGER G. BATES. 331 pp., illustrated. John Wiley & Sons, 440 Fourth Avenue, New York 16, N.Y. (1954) $7.50.

This book was written with two objectives: "to present the theoretical and experimental basis for a practical electrometric scale of activity and to compare the various possible scales with respect to their validity and usefulness; and secondly, to prepare a practical handbook of the many experimental aspects of pH determinations for the assistance of all who measure pH." Order is brought to the field through this two-fold attack and a complete survey of every aspect of pH given. Several of the chapters comprise self-contained reviews. Among these are the definition of pH scales, the establishment of pH standards, and the properties of glass electrodes. Used as a handbook, the reader will find specific details on the pH meter, the preparation of accurate standard solution, the function of the automatic titrator, and a host of other important topics.

LABORATORY MANUALS

The Fetal Pig, A Photographic Study. W. L. EVANS and ADDISON E. LEE. Photographs by GEORGE TATUM. 51 pp. Looseleaf. Hemphill's, Austin, Texas. (1954).

General Zoology. Laboratory Study Guide. SUMNER O. BURHOE. 120 pp. Section of blank pages for illustrations. Burgess Publishing Company, 426 South 6th St., Minneapolis 15, Minn. (Revised edition, 1954) $2.40.

THE AIBS SECTION OF THE REGISTER

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American Institute of Biological Sciences
2101 Constitution Avenue
Washington 25, D. C.

Biologists in the Pharmaceutical Industry

HANS MOLITOR, M.D., Director

Merck Institute for Therapeutic Research, Rahway, N.J.

DURING the past quarter of the century, particularly the last decade, the pharmaceutical industry has undergone an extraordinary period of growth as well as experiencing a change in the type of products manufactured. Vitamins and antibiotics, practically unknown in the mid-thirties have moved into places of highest prominence; so have some of the hormones, particularly those of the adrenals and the sex glands. Most of these products, which in sales volume and dollar value surpass such "old line" pharmaceuticals as barbiturates, digitalis preparations, sedatives and analgesics, etc., require in some phase of manufacture the work of biologists, either for bio-control or, for some part of their synthesis, as for agents prepared by fermentation procedure, e.g., the antibiotics and certain vitamins. Numerous other biologists are employed in the research laboratories of the pharmaceutical industry which since 1930 has expanded its research facilities at least ten-fold. It is the purpose of this article to review briefly the opportunities offered biologists in the pharmaceutical industry and to describe the character of work and conditions of employment in order to assist the more recent graduates and young post-graduates in making a decision as to whether or not a career in the pharmaceutical industry might be to their liking.

Before entering into the subject matter proper, it would seem helpful to define the terms "pharmaceutical industry" and "biologists". Until some twenty-five years ago there was a fairly sharp line of distinction between the functions of the chemical industry, the pharmaceutical industry and the pharmaceutical houses. The chemical industry sold starting materials for the synthesis or extraction of drugs to the pharmaceutical industry which in turn manufactured them in bulk for sale to the pharmaceutical houses. The latter compounded, subdivided and finished and then sold the finished products to hospitals, pharmacists, and the public generally.

Gradually these dividing lines became less definite and today more and more pharmaceutical manufacturers are processing bulk material into the finished medicament and selling it to the public, while many pharmaceutical houses have gone into the manufacture of the fine chemicals which formerly they bought from the pharmaceutical industry. On the other hand, the distinction between "chemical industry" and "pharmaceutical industry" has remained fairly unchanged; only relatively few of the chemical manufacturers are engaged in the manufacture of pharmaceuticals, still fewer in their distribution. Another change, brought about by the advent of vitamins and other dietary agents, is the introduction of pharmaceutical products into the food field; drugs of this type, e.g., multi-vitamin preparations, are often taken for prophylactic purposes and this is one of the reasons for the extraordinary growth in the sales of these products. Somewhat analogous to this is the addition of vitamins and antibiotics to animal feed; although finished products of this nature are not being handled by the pharmaceutical industry it nevertheless provides some of the specific ingredients either in the form of bulk or pre-mixes. Also, the use of medicated feeds, e.g., by addition of a coccidiostat, practically unknown ten years ago, has so rapidly grown in popularity that today it constitutes a major outlet for drugs of this type. Lastly, the use of vaccines, sera, blood, blood plasma and plasma volume extenders which are manufactured by some pharmaceutical houses has vastly grown during and after World War II and obviously is one of the fields in which the pharmaceutical industry needs biologists. The above description of the activities of the pharmaceutical industry is sketchy and rather brief but may be sufficient to delineate the area with which this article will deal.

The term "biologist" is perhaps even more difficult to define than that of "pharmaceutical industry", and for the purpose of this paper the lines of demarcation must be drawn rather arbitrarily. Physicians and veterinarians undoubtedly are biologists in the broadest sense of the word, particularly when engaged in pharmacological, bacteriological, biochemical, nutritional, etc., research, yet for the purpose of this article their opportunities in the pharmaceutical industry will be considered only if an M.D. or D.V.M. degree is not a prerequisite for the type of work which they may be doing. Similarly, biochemists undoubtedly are often engaged in biological work and can be considered full-fledged biologists; again, and only for the purpose of this article, their work will be considered only to the extent to which it could be performed by individuals with a general training in biology but not necessarily requiring specialization in biochemistry. It should be noted, however, that the pharmaceutical industry employs a large number of biochemists in research laboratories and manufacturing operations, and that any of the general comments about employment conditions and opportunities in the pharmaceutical industry apply to biochemists no less than to the other types of biologists more specifically discussed in the following, viz., pharmacologists (including physiologists), microbiologists, zoologists (including parasitologists and entomologists) and botanists.

It is difficult to estimate with any degree of accuracy the numbers of biologists employed in the pharmaceutical industry since no statistical data of recent origin are available. However, it can be safely stated that the pharmacologists and microbiologists constitute the largest number and the botanists probably the smallest. The latter are primarily needed for the identification of botanic specimens and to a lesser degree for the culture of medicinal plants. Other biologists who find increasing opportunities in the pharmaceutical industry are the nutritionists. Usually their formal training is obtained in biochemistry, although many more universities now confer degrees in nutrition. In the pharmaceutical industry such workers are needed for research and analysis (bio-control) particularly in the vitamin and nutrition field.

Before entering into a discussion of the opportunities offered by the pharmaceutical industry to biologists, in particular microbiologists and pharmacologists, and the demands made of them, it may be of interest to review briefly the general condition of that industry during the last decade. It is well known that in keeping with the general trend, the chemical industry, and more specifically the pharmaceutical industry, place an ever-increasing emphasis on research and on scientifically up-to-date and highly efficient methods of production. The following data are cited from several recent surveys, particularly the one conducted in 1952 by Dearborn, Kneznek and Anthony, entitled, "Spending for Industrial Research, 1951-1952". The drug industry is among the upper half of all industries supporting research and it ranks at the very top with regard to the percentage of sales spent on research (approximately 5%). Approximately 92% of this research is performed in the industry's own laboratories and only 8% is spent outside either in commercial testing laboratories or through grants in universities. The trend to support research increased for the drug industry within one

year (from 1951-1952) by approximately 12%. It may also be of some interest that the number of companies supporting research increases with the size of the company, being 30% for companies with fewer than 500 employees, 80% for those with 500 to 2000 employees and 92% for those between 5000 and 7000 employees. Many of the leading pharmaceutical companies are in the second and third groups.

In addition to the need of the pharmaceutical industry's research laboratories for biologists, they also are required in ever-increasing numbers for production and control. The latter is particularly true in the antibiotic industry which since World War II has grown almost ten-fold from a state of virtual non-existence 15 years ago and which today enjoys a sales volume of over 200 million dollars.

Growing skill in the use of fermentation techniques has led to a utilization of these methods in the manufacture of products other than antibiotics, for example, vitamins, (riboflavin, ascorbic acid, vitamin B_{12}), hormones or products such as ergosterol, ephedrine, gluconic acid, citric acid, etc. It need hardly be pointed out that today these products, together with the antibiotics, constitute a large portion of the pharmaceutical business, and hence vast employment opportunities for biologists are available which did not exist ten years ago. While these newer production methods require primarily microbiologists, particularly those with an additional training in chemical engineering, employment opportunities for pharmacologists have likewise greatly expanded. There are several reasons for this, the number of research laboratories itself is far greater today than one or two decades ago, the need for pharmacologists has become more fully recognized, the requirements for pharmacological data have greatly increased due to more stringent requirements by the Food and Drug Administration and other official or semi-official agencies such as the Council on Pharmacy and Chemistry of the A.M.A. and, last but not least, by the demands of clinical investigators themselves who are increasingly disinclined to evaluate a new agent unless it is accompanied by a fairly thorough analysis of its pharmacological and toxicological properties. Very many new drugs submitted for clinical trial fail to pass the grade and are never marketed, and much painstaking and time-consuming pharmacological and toxicological work is done in vain. Nevertheless, it has to be done in order to determine the possible value of the new agent and it requires many skilled pharmacologists to do it.

Still many other biologists are needed in the manufacture of the so-called "biologicals", viz., sera, vaccines and related products for their production as well as for control and research. The very recent introduction of tissue culture techniques for the production of polio vaccine is likely to lead to an expansion of these methods and in view of the technical difficulties inherent in these techniques this will almost certainly provide new opportunities for trained biologists.

What are the specific requirements made of biologists by the pharmaceutical industry and what are the conditions of employment offered to them? Referring specifically to the largest groups—microbiologists and pharmacologists—we find that conditions vary considerably largely due to the academic curricula and types of training offered each.

Many schools offer a well-rounded theoretical and practical education in microbiology and graduates of such schools with an M.S. or Ph.D. degree often require only a minimum of "on-the-job" training. Hence, a degree in microbiology, whether M.S. or Ph.D., is usually regarded as an indication of greater potential proficiency of the new employee and hence has some significance in terms of compensation and placement. Pharmacology, on the other hand, has less formalized curricula; only relatively few schools offer higher degrees and a very recent survey (1954) undertaken for the American Society of Pharmacology and Experimental Therapeutics revealed that approximately only one-half of all biologists with college or doctorate degrees employed in the pharmacological laboratories of the pharmaceutical industry actually ever had specialized training in pharmacology, and even fewer a formal degree in pharmacology. The same survey also showed that the majority of directors of pharmacological laboratories in industry fail to attach particular value to an M.S. degree in pharmacology and definitely prefer men with a doctorate; otherwise, and particularly in the case of technicians, the training is "on-the-job" and the need for a B.S. or M.S. degree in pharmacology is generally not regarded as too important or justifying a higher compensation. The value of an M.S. degree for pharmacologists may increase as the curricula become more standardized and the probability increases that the graduate with an M.S. in pharmacology will offer definite advantages in practical and theoretical knowledge over one with a B.S. degree in biology. However, the big break in prestige and salary for the pharmacologist employed in the pharmaceutical industry occurs at the Ph.D. level. Although such a sharp difference is less pronounced in the field of microbiology, here too the Ph.D. degree is likely to constitute a sharp dividing line. Here as well as in pharmacology, students would be well advised to obtain the doctorate degree if at all possible.

There has been much discussion whether for pharmacologists a Ph.D. or an M.D. degree is preferable. Until about 1930 the majority of the chairs in pharmacology departments of American universities and practically all of the directorships in industry laboratories were held by men with a Ph.D. degree whereas in Europe the opposite was the case. In recent years, however, there has been a distinct trend towards complete medical training as the most desirable background for specialization in pharmacology, a trend which first became pronounced in university appointments, particularly in medical schools and which has extended to industry. The ideal "compromise" solution obviously would be to obtain both the M.D. and Ph.D. degrees, with the only question remaining in which order this should be done.

As principal advantages of a medical background for pharmacology the following are being cited: the likelihood of better understanding and more critical appraisal of the ultimate value of a new drug, the possibility of extending pharmacological investigations to the bedside and to trials in human volunteers (an evergrowing tendency!), the greater ease with which contacts can be made with clinical investigators, and lastly, the greater economic security which an M.D. degree provides since its holder has open to him laboratory appointments in universities, government or industry, administrative positions, and the possibility of a part-time or full-time medical practice. Incidentally, the latter practice is regarded as highly desirable by many pharmaceutical industries, since it assists in maintaining a balanced point of view and prevents the researcher or administrator from developing an ivory tower attitude.

The advocates of a Ph.D. degree point out, on the other hand, that the medical curriculum is so full with clinical training and its theoretical prerequisites (physiology, pathology, biochemistry) that it leaves no room for training the student in the mechanics of doing research which in the Ph.D. doctorate training is provided by the requirement of a doctor's thesis. Undoubtedly, there is much truth in this as anyone can attest who had occasion to compare the performance in laboratory research of a freshly graduated Ph.D. with that of an M.D. On the other hand, the time necessary to acquire both degrees as well as specialized practical training in pharmacological research under guidance of an experienced teacher is so long and the cost so high as to be prohibitive in many cases. The most recent survey of the American Society of Pharmacology and Experimental Therapeutics indicates that for positions in the pharmaceutical industry practical postdoctorate experience is generally regarded as more important than the type of doctorate held by the candidate (Ph.D. or M.D.) although everything else being equal preference was given to the M.D. degree.

It may be of some interest to review briefly the type of work which biologists in the pharmaceutical industry may be asked to do. Broadly speaking, they are likely to work either in the laboratory, in administration, in marketing, or in production (the latter applies particularly to microbiologists). In the laboratory they may be engaged in either strictly research, in analysis or in quality control. In marketing, biologists are employed to a limited extent as "detail men" (visiting hospitals and physicians and informing them of recently introduced medicaments or new uses of already known drugs). In administration, positions of laboratory heads and research directors are open to biologists, particularly to those with a combination of trainings, such as pharmacology and chemistry, microbiology and engineering, medicine and pharmacology, etc. In production, microbiologists are needed in large numbers for the supervision of fermentation processes and for the manufacture of sera, vaccines, etc.

More specifically, the tasks facing a microbiologist in a research laboratory might be as follows: Improvement, particularly through mutation, of strains used as seed material for the production of antibiotics, vitamins, organic acids, etc.; improvement of media to provide better yields; development of microbiological assay techniques for the isolation and identification of new vitamins or other micro-nutrients (it is a well established fact that success in chemical research in this field largely depends upon the availability of an assay which is accurate, economical and fast; only few animal assays possess all three of these attributes and are comparable with microbiological or chemical techniques).

One of the most important tasks of the microbiologist is the screening of cultures for new antibiotics. Non-existent as recently as 15 years ago, this assignment now has become one of the most important in the pharmaceutical industry since it still is the only method of finding new antibiotics. Microbiologists are also needed to test routinely many products of the pharmaceutical industry for sterility and, in the case of vaccines and sera, for potency.

Much research is also undertaken to find microorganisms capable of performing certain chemical operations, such as steroid transformations, formation of sorbose from sorbitol, etc. In many instances this method of production has proved preferable to strictly chemical procedures in the manufacture of intermediates as well as that of the final product.

The other large group of biologists employed by the pharmaceutical industry, viz., pharmacologists, may be called upon to perform one or several of the following tasks: (a) *Determination of pharmacological and toxicological properties:* Any new agent must be examined for safety of use before it is submitted to clinical tests and the clinician expects specific warnings regarding possible side effects, for instance, the possibility of damage to the kidney, liver, heart, hematopoietic system, etc. If in preliminary clinical trials the new drug appears to be promising, pharmacological and toxicological tests then must be conducted on a much broader scale to furnish the data needed for release by the Food and Drug Administration. Such studies often go beyond the minimum governmental requirement and include chronic tests which may extend over one or two generations of test animals. (b) *Development and application of bioassays:* The search for new agents hinges to a large extent upon the availability of accurate and practical bioassay procedures. This is applicable to the isolation of the active principles from organic and inorganic source materials as well as to synthetic compounds. The pharmacologist (or in nutrition research, the nutritionist) is called upon to devise such assay procedures, often by itself a major research project, and to apply them routinely after they have been standardized. (c) *Screening for new drugs:* One of the most common methods of arriving at new therapeutic agents is the routine testing of large numbers of compounds for certain well-defined properties such as analgesic, diuretic, antispasmodic, etc. Once a drug has been found to possess one or more of the desired properties as well as a satisfactory safety margin it is subjected to more complete pharmacological investigation. The pharmacologist is called upon to devise the various tests, apply them or supervise their application and interpret the results. (d) *Biological Control:* It is the pharmacologist's task to develop biological quality standards for a new drug and to perform or supervise their application. If the drug is a well-defined chemical compound the number of pharmacological tests routinely performed is limited; however, for galenic extracts or chemically impure agents such as insulin, ergot, digitalis, etc., the biological standardization must assure potency as well as freedom from unusual toxicity.

In principle, the activities performed by other biologists in the pharmaceutical industry are similar to those of the microbiologists and pharmacologists; the nutritionist investigates or assays new nutritional factors; the parasitologist applies himself to the testing of agents against malaria, schistosomiasis, amebiasis, various types of helminthic infections, etc.; and the botanist or pharmacognosist identifies botanical source materials, etc. All of them fulfill a vital function in the long and often difficult process which eventually leads to a useful medicament.

It is safe to assume that the total number of biologists employed in the pharmaceutical industry exceeds several thousand and that it is steadily increasing. Although this number is small in comparison with that of chemists employed in the chemical or the pharmaceutical industry it is not met by the available supply of trained personnel and a career in pharmacology or microbiology is certainly promising, particularly if the training is continued to the doctorate degree.

One of the questions frequently asked by college and university graduates contemplating employment in the pharmaceutical industry concerns the relative advantages of employment in industry and in university or governmental service. The difference in pay which at one time was rather marked has been substantially narrowed, although it is still quite pronounced particularly in the lower and medium grades and is likely to remain so. The prospects for advancement, particularly at the B.S. or M.S. levels, are likely to be better in industry than in academic laboratories; and at these levels security of employment is as good in industry as in university or governmental positions. Provisions such as sick benefits, hospitalization, pensions, etc., are about the same in universities, industry and government. Biologists in industry are likely to work under greater pressure than in universities, and freedom to select their field of work or their research projects probably is more limited; however, such a limitation exists also for a large percentage of the younger biologists who serve as assistants and technicians in university or government laboratories. On the other hand, industry offers a research worker the opportunity to work closely with experts of a wide range of training and the satisfaction to see his discovery grow from a laboratory observation to an important new product manufactured in large quantities. Such a broad view of biology is rarely available to those engaged in academic or governmental research.

By and large, the chances for reaching a well-paid and secure position are probably better in industry than in universities largely because more such positions are available. The degree of satisfaction will largely depend upon the individual's preferences and aspirations and the policies of the particular industrial concern. In both instances very wide differences are bound to exist and one of the best suggestions that can be made to the young biologist is to try, compare and judge for himself. With life in a college or university he is at least somewhat familiar, but it is the atmosphere of industry which he has yet to explore and he might do that best by taking temporary employment during one or more of his college vacations. A number of pharmaceutical industries have provisions for such temporary employment and whenever possible, young students should avail themselves of this opportunity.

A Survey of Biological Abstracting

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PART I

WHAT scientist has not been appalled by the year-round flood of published scientific researches? Who has not despaired of keeping up with the new literature even of his own restricted field—particularly in the biological sciences, which now contribute about half of the flow of new publication? Dozens of new scientific journals have been founded since the close of World War II, and most of those that were temporarily suspended during and after the hostilities have by now resumed publication. The volume of biological research being carried on in Japan, in India, in Australia, in South Africa and South America has reached proportions commensurate with those of North America and Europe. The problem of language becomes daily more serious. In the face of this situation many scientists have frankly acknowledged themselves defeated, have become more and more specialized, more and more provincial in knowledge and outlook. This development constitutes as grave a threat as any to the international character of science and the integration of scientific knowledge.

The key to this problem lies in the development of much more efficient and universal indexing and abstracting systems than now exist, for today a multiplicity of such services are operating without coordination or over-all plan, just as they happen to grow up in response to immediate need. Obviously their efforts in great measure overlap; equally obviously, great areas of the literature are scarcely covered at all. The time is ripe to bring some system into this chaos, to build upon some of the exploratory efforts made by UNESCO. The United States, as the wealthiest and now scientifically most productive nation, must lead in such an undertaking. But how start?

In order to provide a clear conception of the present situation and to indicate the directions in which planning should proceed, a Survey of Biological Abstracting, supported by funds from the National Science Foundation and other agencies, was conducted under a contract with *Biological Abstracts* during the period between August, 1952, and the end of January, 1954. An Advisory Committee of biologists representing different fields helped to plan the work of the Survey, and a staff of 12 persons was engaged for part-time work. The writer served as Director of the Survey. In previous studies of the same general nature, such as the Physics Survey of Abstracting and the Survey of Physiology, information has been sought from scientists by questionnaire. Because opinion may fail quite badly to reflect the true state of affairs, and yet has a certain importance in its own right, it was decided in the present instance to undertake a program composed of two distinct parts: (1) a statistical analysis of the current effectiveness of biological abstracting services, and in particular of Biological Abstracts; and (2) a sampling of opinion among American and foreign biologists, by means of a questionnaire, in regard to the use, merits, defects, and desired changes in the over-all abstracting program.

The mimeographed report of the Survey of Biological Abstracting is 63 pages in length. It is hoped that in the near future it can be reproduced in full for distribution to all workers who may wish to have access to the statistical details. If such persons will write to the AIBS office, 2101 Constitution Ave., Washington 25, D. C., the resulting knowledge of the demand for the full report will be very helpful. Meanwhile, it seems desirable to present a summary of the data obtained and the conclusions to be drawn from them, along with the tentative recommendations for the first steps to be taken to cope with the abstracting and indexing problem more effectively. The findings respecting the actual state of abstracting—proportion of coverage of the literature, delay in publication of abstracts and indexes, overlapping between services, etc.—will be presented first, so that in the final instalment of this report the present consensus among biologists on these matters can be evaluated in the light of known facts.

Four separate statistical analyses were conducted in order to answer, if possible, the following questions: (1) what proportion of the world's biological literature is being abstracted? (2) in those journals stated by a particular service to be covered, what proportion of articles published is actually abstracted? and how long is the average interval between publication of article and publication of abstract? (3) what is the extent of overlapping between abstracting services—specifically, between *Biological Abstracts* and other individual services? (4) what is the completeness of coverage of particular subjects by *Biol. Abstr.* in comparison with available, "complete" bibliographies?

The Magnitude of the Biological Literature

The very first question is: how many biological journals carrying reports of original research or publishing review articles are currently being published throughout the world? To estimate that number precisely is clearly impossible, because of the difficulty of classifying journals that are doubtful, whether because they cover borderline fields or attempt a general coverage of several or many sciences, or whether because they include much material that is neither a report of original research nor a characteristic scientific review, such material, e.g., as scientific news, editorials, or popular articles. Nevertheless, an effort was made to separate the strictly biological research and review journals from those biological only in part, and both of these categories from those scientific journals belonging almost wholly to non-biological fields. An appraisal was then made of the proportion of all existing biological journals covered by *Biol. Abstr.*, both in terms of the world total and by countries and languages. This project was carried out almost entirely by Dr. V. P. Sokoloff, a Russian-born soil scientist broadly acquainted with such fields as plant physiology, biochemistry, and geology. His knowledge of current Slavic journals was of inestimable value in enabling an appraisal to be made of coverage by language groups.

The basis of the estimate for the world total of biological journals was the recent (1952) Third Edition of the *World List of Scientific Publications*, 1900-1950 (Oxford). As a sample every tenth page was taken, the total yielding 5264 titles of presumably current journals. Of these, 2087 (39.7%) were classified as biological, in whole or in part. The world total of current biological (including medical and agricultural) journals was thus estimated to be about 21,000. Some of those in the sample are assuredly no longer current; but on the other hand, as a check of the Slavic journals showed, there are also omissions in the *World List* besides the

constant accretion of periodicals newly established. All in all, it seems very likely that the real total is larger, rather than smaller, than the present estimate of 21,000. The Library of Congress now has under way a new compilation of all current scientific journals, and according to Dr. Raymond Zwemer, who is director of this listing, there are over 20,000 biological journals in a world total of approximately 40,000 technical and scientific periodicals. The number of journals that are biological, in the narrow sense, i.e., excluding the medical and agricultural periodicals, is of course much smaller. No accurate estimate has yet been made of their proportion in the whole.

The list of journals covered by *Biol. Abstr.* (1953) includes 2447 titles, of which 241 are "non-biological" according to the criteria that were used in estimating the world total from the *World List*. *Biol. Abstr.* therefore covers 10.5% (2206/20,870) of all, and no more than 14.4% (1198/8350) of the more strictly, biological journals. It is striking that almost half of the journals covered by *Biol. Abstr.* are only partly biological, and that about 10% of the journals covered by *Biol. Abstr.* are in such non-biological fields as geology, geography, astronomy, engineering, etc.

The distribution by language of the journals was as follows: (percentages)

	English	*Romance*	*Germanic*	*Slavic*	*Others*
WORLD LIST sample	33.0	32.5	19.5	9.7	5.3
WORLD LIST (corr.)	35.3	34.7	20.9	3.5	5.6
BIOL. ABSTR.	53.4	24.2	14.3	3.0	5.1

It is evident that, as might be expected, *Biol. Abstr.* devotes relatively fuller coverage to publications in the English language and is relatively poor in covering those in the Romance and Germanic languages. "Others" is comprised mainly of Japanese journals, and here the representation of *Biol. Abstr.* is creditable. As for Slavic journals, it was found that the sample from the *World List* considerably overrepresented the actual total in this category, and the correction above was made by using the total of Slavic journals found in the entire *World List* and distributing the remainder proportionately to the four other categories. When this is done, *Biol. Abstr.* exhibits a just proportion of coverage of the Slavic journals, in fact, superior to the coverage of this language group by *Chemical Abstracts*, which tends to concentrate on the Russian journals and neglect those in Polish or Czech. On the other hand, the list of biological and medical periodicals compiled by the Welch Medical Library slights the Ukranian journals and overrepresents the Serbocroation journals; and the list of the U. S. Department of Agriculture slights both the Bulgarian and Ukrainian and overrepresents the Czech journals—when each is compared with the total listing of journals in Slavic languages given by the *World List*.

Another study carried out by Dr. Sokoloff was with the aim of seeing how complete the total list of Slavic journals in the *World List* might be. Checking titles of Slavic journals from the lists of *Chemical Abstracts*, *Biological Abstracts*, and the U. S. Department of Agriculture, 11 new items were found in a sample of 103. The world total of Slavic biological journals is therefore probably about 10% greater than the 729 named in the *World List*. If this language group is as poorly represented as any, then the estimated world total of biological journals should be increased by 10 per cent. This would set the probable upper limit of the estimate at about 23,000.

Complete indexing, to say nothing of complete abstracting, of a volume of biological publication roughly ten times what *Biol. Abstr.* is now able to handle, seems at present quite out of the question. Yet if selection must be made, should it be haphazard? To sort the most significant scientific journals from the valueless, or the individual grains of wheat from the chaff, in so many different languages is truly a herculean task! It can probably be accomplished only by the collaboration of biological scientists of wide knowledge, jointly representing every major area of biology in every language. It is definitely not a task for any single editor or small board of editors, but for an international commission of the widest scope. The problem should be referred to UNESCO and the International Union of Biological Societies for action.

Meanwhile would it not be more appropriate for *Biol. Abstr.* to attempt a completer coverage of the biological journals themselves before branching into peripheral areas that are presumably covered by other special abstracting services?—particularly since no other biological abstracting service publishes more abstracts annually or covers more journals than *Biol. Abstr.*, and it therefore seems very unlikely that all the abstracting journals together cover even half of the existing biological and partly biological periodicals.

Completeness of Coverage Within "Covered" Journals and the Lag in Publication of Abstracts

If the abstracting of articles from the 10 per cent of all biological journals listed by *Biol. Abstr.* as "covered" was uniformly nearly complete, and if other abstracting services did equally well, without much overlapping between any of them, then at least a representative portion of the most significant new research would be rendered available to the worker. This brings us to the second question investigated: what is the proportion of coverage by *Biol. Abstr.* for the journals on its list, and equally significant, what on the average is the lag between the appearance of article and abstract? The comparative studies of different abstracting services, given in a later section, indicate that the coverage achieved by *Biol. Abstr.* is not atypical.

Forty-two journals were selected, as representatively as possible, to determine these points. Journals were classified three ways: (a) according to national origin and language; (b) according to whether authors themselves furnish abstracts or not; and (c) according to whether the journals are wholly biological or partly biological. There were 27 U. S. journals, 5 British, 6 Germanic, and 4 in the Romance languages; there were 21 author-abstracted and 21 not; and there were 38 wholly biological and 4 partly biological journals. The selection of approximately two-thirds U. S. journals was considered justified because at the present time 40 to 50 per cent of all biological articles are being published in U. S. journals and *Biol. Abstr.* is itself published in the United States. The lack of Slavic journals was compensated for by the appraisal of the coverage of these already described. As compensation for the lack of Spanish journals, special attention was given to Latin-American journals in the comparison of the *Bibliography of Physical Anthropology in Latin America* with *Biol. Abstr.* (see below). Time and expense prevented any special study of Japanese publications and the abstracting of Japanese articles, except in so far as they were covered in general comparisons of different abstracting services.

In the group of selected journals, the general representation of the zoological and botanical sides of biology, as well as the morphological, physiological, and biochemical aspects, was fairly good. Of the two major applied branches of biology, medicine was well represented, whereas agriculture did not receive sufficient attention. However, the differences to be found in the effectiveness of coverage by *Biol. Abstr.* seemed little related to subject fields, but correlated much more strikingly with the language and national source of the journals, and with the provision of authors' abstracts.

In analyzing the sample, the period 1947-1949, inclusive, was taken as the test period, since this was the most recent 3-year period for which abstracting had been completed by *Biol. Abstr.* Independent checks of the same journal by two different workers showed that our collection of data possessed

high reliability. All articles, or, in the case of journals with more than 1000 titles within the period, a random sample of the articles, were checked through the Author Index of *Biol. Abstr.* It should be pointed out that the failure to locate an abstract of a particular article might either be due to an actual failure of *Biol. Abstr.* to abstract it, or alternatively to some error in the Author Index that made it impossible to locate the abstract. Two independent estimates of the frequency of errors in the Author Index (5.33% and 2.6%) made it appear of little consequence to try to distinguish between errors of the index and actual failure to abstract.

For the U. S. journals, the interval between publication of article and publication of abstract averaged, for the author-abstracted group, 0.66 yr. (range: 0.36-0.95 yr.); for the non-author-abstracted group, 0.9 yr. (range: 0.63-1.66 yr.). For the author-abstracted group, a standard of a 4-month's lag seems attainable; for the non-author-abstracted group, one of 8 months. Although some improvement in the speed of publication of abstracts may be possible, the present record seems to be quite satisfactory for this group of journals.

For the British journals, the lag averaged 0.67 yr. for the author-abstracted journals and 0.99 yr. for non-author-abstacted journals—figures not significantly different from the record for U. S. journals. The European journals averaged 0.94 yr. for the sole author-abstracted journal included in the study; and 1.43 yr. for the 9 non-author-abstracted journals (range: 1.14-1.98 yr.). The speed of abstracting for this group could surely be considerably improved, and a standard of one year from date of publication of the original article maintained.

When we turn to the analysis of the proportion of the articles from these journals found to be abstracted in *Biol. Abstr.*, the record cannot be considered nearly so satisfactory. Among the American journals, 11 out of 18 author-abstracted journals yielded a score of better than 90% of all articles abstracted, and 7 of these had more than 95%. The best records were those for the Wister journals and certain others which require authors to send in abstacts along with the original manuscripts, the editors then routinely forwarding the abstracts to *Biol. Abstr.* It was apparent that reliance on the authors themselves to send in abstracts voluntarily is ill-founded. It results, on the average, in a loss of about 15%.

Further study is probably needed to determine why there is such an extraordinary range in the completeness of abstracting among the U. S. non-author-abstracted journals (mean: 31.1% not abstracted; range: 3.7%-69.1%). Some, such as *Physiological Reviews* and *Zoologica*, received excellent coverage, whereas 6 out of the 9 showed a failure of coverage exceeding one-fifth of all articles. The two partially biological journals included in this group, *Science* and the *Proceedings of the National Academy of Science* (Wash.) were relatively neglected (41.1% of biological articles uncovered). It would seem unquestionable that journals of such high standing and wide range of subject matter should receive due attention in the abstracting program.

In the case of the British journals, the average coverage fell within the ranges for the corresponding categories of U. S. journals. Again, the non-author-abstracted groups revealed considerably poorer coverage than the author-abstracted group. Very striking was the poor coverage of *Nature*, so widely regarded as the most important general scientific periodical in the world. Of its biological articles, 58.5% were not abstracted in *Biol. Abstr.* Investigation showed that here, as in the case of *Science*, alternate issues had been assigned to different abstractors in order to lighten the load, and the poor record was in large part due to the failure, over the space of nearly 2 years, to obtain any abstracts at all from one abstractor.

As to the European periodicals, it was found that on the average *Biol. Abstr.* covered only 65% of all articles in the selected journals. Not even the author-abstracted *Revue Suisse de Zoologie* was more than three-fourths abstracted. The percentage of articles *not* covered ranged from 15.4% to 69%, the latter being the important French journal, *Comptes Rendues de la Société de Biologie* (Paris), and the next poorest coverage that of the outstanding German weekly, *Die Naturwissenschaften*, which holds the place among German-speaking scientists that *Nature* and *Science* hold among those who speak English.

In short, this study showed that, except in the case of the foreign journals, the lag between publication of original article and abstract thereof was not as great as many persons have apparently supposed it to be. On the other hand, the over-all record of coverage of articles in those journals supposed to be abstracted can only be characterized as deplorable. It would be worthwhile to find out just what procedures are used in the case of those journals that are covered relatively completely.

A Comparison of Different Abstracting and Indexing Services

Because of the very high regard in which *Chemical Abstracts* is held by many scientists, it was of particular interest to compare the record of coverage made by *Chem. Abstr.* and by *Biol. Abstr.* for some topic in a field of mutual concern to chemists and biologists. For this purpose the section on *chemotherapy* in *Biol. Abstr.* was selected, and all articles originally published in 1949 and thereafter abstracted in *Biol. Abstr.* were checked against *Chem. Abstr.* The converse procedure was used for the section entitled *antibiotics* in *Chem. Abstr.* The analysis demonstrated that *Chem. Abstr.* was by no means exhaustive in its coverage of the subject, and that the majority of omissions (53.3%) were in journals *Chem. Abstr.* was supposed to be covering. Even excluding all clinical articles, *Chem. Abstr.* covered only 44.8% of the listings on chemotherapy in *Biol. Abstr.*; while *Biol. Abstr.* covered 42.3% of the articles on antibiotics listed in *Chem. Abstr.* The record of *Chem. Abstr.* was poorest for U. S. journals, that of *Biol. Abstr.* for foreign journals. These results may imply that *Chem. Abstr.* deliberately dropped certain articles on chemotherapy because, although experimental in nature, they were not strictly of chemical interest; whereas the omissions by *Biol. Abstr.* might all have been due to inadequate coverage. Even if this were true, it remains a fact that no worker in such borderline areas as chemotherapy and antibiotics could find references to more than some 40% of the papers on his subject unless he consulted both of the two abstracting services.

In a comparison of foreign versus domestic (U. S.) coverage by *Chem. Abstr.*, *Biol. Abstr.*, and the *Berichte über die gesamte Biologie—Abt. B*, remarkable agreement was found between the three services, in spite of the natural tendency of the *Ber. ges. Physiol.* to emphasize the Germanic languages.

Studies similar to the comparison of *Biol. Abstr.* and *Chem. Abstr.* were made of the overlapping between *Biol. Abstr.* and *Psychological Abstracts*, with the topic *animal behavior* (articles published in 1950) in *Biol. Abstr.* checked into *Psychol. Abstr.* and all 1950 articles on physiological psychology in *Psychol. Abstr.* checked into *Biol. Abstr.* The record of the two abstracting services was found to be about the same in respect to promptness. Approximately two-thirds of the articles abstracted in either one of the two abstracting journals were not to be found in the other. This means that a bibliography prepared on either topic from both abstracting journals combined would include approximately 166% of the

items found in either one alone. On mutually relevant topics the percentage of overlapping between *Biol. Abstr.* and *Psychol. Abstr.* was 10% less than that between *Biol. Abstr.* and *Chem. Abstr.*

In cross-checking between *Biol. Abstr.* and the *Bibliography and Index of Geology Exclusive of North America*, and using the section on *paleozoology* in the former and all paleontological articles listed in the latter, *Biol. Abstr.* came out favorably, for it contained a considerably higher proportion of articles not in *Bibliog. Geol. excl. N. Amer.* (69.2%) than the latter contained of articles not in *Biol. Abstr.* (46.7%). But in this particular subject the lag in publication of abstracts in *Biol. Abstr.* is very great (approximately 50 per cent delayed 3 yr. or more).

For a comparison of *Biol. Abstr.* with the *British Abstracts of Chemistry and Physiology*, the Bibliography of Cerebral Circulation (1938-1947) was used. It was found that if the British and U. S. articles were pooled, the amount of coverage for the English language by the two abstracting journals was identical (40.7% of all articles in the Bibliography), although each service was superior in its own domestic coverage. In both cases, coverage of journals in foreign languages was only half as thorough as the coverage of those in English.[1]

Further comparisons were made between *Biol. Abstr.* and other abstracting or indexing services wholly biological in coverage and less general than *Biol. Abstr.* These included the *Bibliography of Agriculture* (U. S. Department of Agriculture), *Excerpta Medica* (Amsterdam), *Resumptio Genetica*, *Helminthological Abstracts*, and the *Zoological Record*. Sections on *forestry* (articles published in 1950) were compared in *Biol. Abstr.* and the *Bibliog. Agric.* and it was found that the latter was vastly more complete and comprehensive an index to forestry (especially its taxonomic aspects) than was *Biol. Abstr.* (92.0% of *Bibliog. Agric.* items not in *Biol. Abstr.*; 24% of *Biol. Abstr.* items not in *Bibliog. Agric.*).

The sections on *endocrines (reproduction/gonads)*, taking all papers published in 1949, were compared in *Biol. Abstr.* and *Excerpta Medica*. The results showed that the coverage of this subject by *Biol. Abstr.* was superior to that by *Excerpta med.* (55% of *Biol. Abstr.* items not in *Excerpta med.*; 37% of *Excerpta med.* items not in *Biol. Abstr*). *Biol. Abstr.* included 1.65 times as many articles on this subject, but the average interval between publication of article and abstract was 0.825 yr. for *Excerpta med.* and 1.02 yr. for *Biol. Abstr.* To verify these conclusions, a second comparison was made between *Excerpta med.* and *Biol. Abstr.*, this time using the sections on *sense organs*, and again for all articles published in 1949. Once again the coverage was far superior on the part of *Biol. Abstr.* (87% of *Biol. Abstr.* items not in *Excerpta med.*; 57.7% of *Excerpta med.* items not in *Biol. Abstr.*). The average lapse of time between publication of article and abstract was 1.09 yr. for *Excerpta med.* and 1.18 yr. for *Biol. Abstr.*, but *Biol. Abstr.* carried 2.5 times more articles. It may be noted that the overlapping between *Biol. Abstr.* and *Excerpta med.* was considerably greater within the former subject than within the latter. [Note, however, that in the comparative study of coverage of items in the Bibliography of Cerebral Circulation (see below) *Excerpta med.* surpassed *Biol. Abstr.*]

For the field of genetics a comparison was made between *Biol. Abstr.* and the abstracting journal *Resumptio Genetica*. The percentage of articles abstracted in *Resumpt. genet.* and not in *Biol. Abstr.* was 38.4%. In this instance no converse procedure was carried out. The zoological and botanical sides of genetics were covered somewhat better by *Biol. Abstr.* than the field of human genetics.

A comparison between *Biol. Abstr.* and the British abstracting journal *Helminthological Abstracts* was based on articles in *helminthology* published in 1951. A total of 1252 were abstracted in *Helminth. Abstr.* and only 447 in *Biol. Abstr.* The comparison clearly indicated that *Helminth. Abstr.* covered the subject of helminthology far more comprehensively and exhaustively than *Biol. Abstr.* (61.2% of *Helminth. Abstr.* items not in *Biol. Abstr.*; 20.4% of items in *Biol. Abstr.* not in *Helminth. Abstr.*). Yet the proportion of articles missed by *Helminth. Abstr.* and found in *Biol. Abstr.* is not negligible.

The comparison of coverage of the same topics by *Biol. Abstr.* and the *Zoological Record* holds particular interest because of the claims made by some taxonomic zoologists in the past few years that *Biol. Abstr.* is worthless in regard to its coverage of systematic zoology and should desist from the effort. The study of these two services was therefore made rather more exhaustively. A representative sampling by phyla of articles published in 1947-49 and listed in the *Zool. Rec.* (1949) served as basis for one check; while articles published in 1949 and listed in the sections on *systematic zoology* in *Biol. Abstr.* served as countercheck. This study indicated that 60-65% of the 13,200 items recorded in the *Zool. Rec.* were not abstracted by *Biol. Abstr.* The proportion ranged from 35% for the Trilobita to 82% for the Aves. The reciprocal check indicated that 17.3% of the items in the section on Systematic Zoology in *Biol. Abstr.* were not recorded by *Zool. Rec.* The proportion ranged from 6.5% for the Arachnida to 35.8% for the Aves. The percentage of the total items (derived from both *Biol. Abstr.* and *Zool. Rec.*) to be found in the *Zool. Rec.* is about 95%; and the percentage of the total to be found in *Biol. Abstr.* is approximately 33.3%. The coverage for the Aves showed the least overlapping between the two services and the greatest proportion of articles found only in *Zool. Rec.* or only in *Biol. Abstr.* It is evident that *Biol. Abstr.* falls far short of giving adequate systematic coverage of animal species, whereas *Zool. Rec.*, although far behind in its compilation—the volume for 1949 appeared in 1952—is nevertheless relatively complete. A suitable plan for collaboration is definitely needed.

The general picture presented by the comparisons of all nine of the abstracting and indexing services that have been compared with *Biol. Abstr.* is one of great heterogeneity. The overlapping ranges from 8% to 83%. In regard to topics of mutual interest, other services have from one-third to nine-tenths of their items not covered by *Biol. Abstr.*; and *Biol. Abstr.* has from one-fifth to nine-tenths of items not covered by the other service. The only generalization that seems of much importance is that neither *Biol. Abstr.* nor any other abstracting or indexing service is very complete in regard to those topics selected as a basis of evaluation. The best of them seem to be the *Bibliography of Agriculture*, *Helminthological Abstracts*, and the *Zoological Record*. Another group may be roughly designated as about equal in effective coverage to *Biol. Abstr.* This group includes *Chemical Abstracts*, *Psychological Abstracts*, and *British Abstracts of Chemistry and Physiology*. Finally, the coverage by *Biol. Abstr.* seems definitely superior to that by the *Bibliography and Index of Geology Exclusive of N. America* or by *Excerpta Medica*. It would undoubtedly be worthwhile to know how some of the other abstracting periodicals published by the Commonwealth Agricultural Bureaux compare with *Biol. Abstr.* A comparative study of *Biol. Abstr.* and *Plant Breeding Abstracts* has just been completed for all articles published in 1951 and listed under the topics "wheat" in *Plant Breed. Abstr.* and "phytopathology—parasitism and resistance" in *Biol. Abstr.* The result: *Plant Breed. Abstr.* covered 64% of the items in *Biol. Abstr.*, while *Biol. Abstr.* covered only 19% of those in *Plant Breed. Abstr.*

[1] Data for this study were compiled by the Survey of Physiology, and kindly made available to us by Dr. Robert Grenell.

A Comparison of the Coverage of Certain Subjects by Special Bibliographies and by Abstracting Services

As has just been described, it is easy to determine the amount of overlapping between two abstracting services for a particular topic, but in order to determine what proportion of all articles on that topic is covered by neither, a complete bibliography of the topic would be necessary. Probably no absolutely complete bibliographies of any topics exist, but some relatively full ones are available. These were used in the fourth type of analysis. Special bibliographies of certain topics, compiled by specialists and presumably exhaustive for the period covered, were chosen, and a reciprocal comparison was made of the coverage of items in the bibliography and in the abstracting journal.

Ten such special bibliographies were used: (1) *Drosophila*, from DIS; (2) *Cerebral Circulation*, from *Physiol. Rev.*, July 1952, by R. Kenk and M. L. Nall; (3) *Guide to the Literature on Collagen*, by R. Borasky; (4) *Plasma Substitutes*, by K. Baer; (5) *Pathology and Physiology of Burns*, by K. Baer; (6) *Literature of the Polychaetous Annelids*, by O. Hartman; (7) *The Pituitary-Adrenocortical Function*, by K. Baer and M. Spencer; (8) *Bibliography of Physical Anthropology in Latin America*, by T. D. Stewart; (9) *The Literature on Streptomycin, 1944-1952*, by S. A. Waksman; and (10) the FIAT volumes, *Biologie* (2 vols.) and *Zoologie* (1 vol.), prepared to summarize German publication during and immediately after World War II. Coverage of the 826 items in the Bibliography of Cerebral Circulation (1938-47) was checked in *Biol. Abstr.*, *Brit. Abstr.*, and *Excerpta med.*, in the latter case only for 1947, the initial year of that abstracting journal. *Biol. Abstr.* covered 31.7% of the total items, *Brit. Abstr.* 33.0%, and *Excerpta med.* 45.9% (79/172). As already mentioned, *Biol. Abstr.* and *Brit. Abstr.* showed equal coverage of journals in English, although the former covered 43.7% of the U. S. items and only 28.6% of the British items, whereas *Brit. Abstr.* covered only 36.9% of the U. S. items and covered 56.1% of the British items. Foreign language coverage was in both instances only half as complete as that of publications in English (18.5% for *Biol. Abstr.* and 21.5% for *Brit. Abstr.*).[2]

Because of the lack of sufficient time and resources to carry out analyses like the above for all abstracting and indexing services, the other 9 special bibliographies were checked only against *Biol. Abstr.* Further studies of this sort ought to be completed for the other abstracting and indexing services.

To summarize very briefly the studies in this project, it may be said that the coverage by *Biol. Abstr.* of the items in special bibliographies on general topics ranged from 18.0% (Plasma Substitutes) to 52.1% (Polychaetous Annelids). The *Drosophila* coverage is like that of the annelids, whereas the coverage of the physiological and pharmacological topics is considerably poorer (18.0-39.9%). Coverage of Latin American Anthropology was poorest of all (16.7%); but, in contrast, the coverage of the wartime German biological literature was surprisingly good. As might be expected, the proportion of new items found in *Biol. Abstr.* and not in the respective special bibliographies was highest for those topics covered relatively well by *Biol. Abstr.* and diminished as the coverage decreased. Thus 83 *Drosophila* items (19.8%) were added by *Biol. Abstr.* to the total; but only 16 items on Collagen (11.6%); and only 4 items on Burns (2.2%).

It will be best to save general discussion and recommendation for the final instalment of this report. It is sufficient to say here that so far the study amply documents the inadequacies and defects of our disorganized efforts to cope with a most serious scientific problem.

[2] See footnote 1.

(to be concluded)

For several years the trustees and staff of BIOLOGICAL ABSTRACTS have felt the need for an independent and unbiased appraisal of the status of biological abstracting in terms of its adequacy and its reception by biologists. Through the good services of the National Science Foundation, funds were made available to BIOLOGICAL ABSTRACTS in 1952 for such a study which was commenced by The Johns Hopkins University under the direction of Dr. Bentley Glass in August 1952 and completed in January 1954. Even before the Survey was finished, however, steps were taken to correct the major defect in service—the tardiness of subject indexes. By limiting the annual publication of abstracts to 30,000 and throwing the personnel and resources thus released into an augmented attack on the indexing job, a program was initiated which calls for the publication of two indexes per year until June of 1956 when the index for the year 1955 will be published. In the meantime, an economical but current control of the abstracts is provided by monthly author indexes which were instituted in January 1954.

With the completion of the Survey of Biological Abstracting in January 1954, however, we were first made fully aware of the truly staggering task which lay before us if we were ever to attain complete coverage of biological literature. If there are indeed 20,000 journals of biological interest currently published throughout the world and if, as a conservative estimate, each of these journals publishes only 15 articles per year, coverage can be obtained only with 300,000 abstracts. The present over-all editorial, indexing and printing costs of an abstract in BIOLOGICAL ABSTRACTS is approximately $6.50. Therefore, complete coverage would probably cost very close to $2,000,000. The 1954 BIOLOGICAL ABSTRACTS' budget is only 10% of this figure.

The practical solution to the problem of coverage seems to lie in elimination of overlapping among various abstracting services and in limiting coverage to those journals publishing reports of original research. Currently the staff of BIOLOGICAL ABSTRACTS is pruning its journal list of the peripheral, popular, and trivial journals and is striving to provide a truly complete coverage of the significant journals of research which remain on its list. This is a task of considerable proportions and with limited resources will take some time in its attainment.

BIOLOGICAL ABSTRACTS can improve the quality of its coverage by continuing study and consultation but it can increase its coverage only in direct proportion to an increase in its income.

G. Miles Conrad
Director, BIOLOGICAL ABSTRACTS

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The Hawaii Marine Laboratory

ROBERT W. HIATT, *Director*

Tidal Ponds at Coconut Island Branch of Hawaii Marine Laboratory, University of Hawaii.

THE mid-oceanic location of the University of Hawaii naturally focuses attention on the important, largely unknown, tropical sea with its abundance of basic and applied problems in the marine sciences. In entering this field, through the establishment of the Hawaii Marine Laboratory, the University undertook one of its special obligations to the world's scientific community. For historical reasons most of the scientific production thus far has been in some aspect of marine biology, but constant encouragement in other marine sciences is beginning to show results in marine geology, chemistry and physics. Although the resident staff is making good use of the facilities, it is the expressed hope of the University that marine scientists the world over will take advantage of this Laboratory so that its maximum potential value may be achieved.

There is no central core along which work at this Laboratory is directed. Rather it is maintained as a facility to encourage any type of marine research which can best be done in Hawaii. Thus far the biological research has fallen into four general categories: first, systematic studies to provide a better knowledge of the organisms present in the Hawaiian Archipelago and the central Pacific; second, studies directed toward understanding the rate by which solar energy is stored by producer organisms and by consumer organisms at higher trophic levels in warm seas, such studies have been accompanied by diverse ecological investigations; third, encouragement for studies which illustrate physiological and evolutionary life processes characteristic of warm water organisms; and fourth, a continuing program devoted to problems concerned with the utilization of marine resources of the area.

No fees are charged for working space or for the normal use of equipment and supplies. Where charges must be levied an understanding will be reached between the visiting Research Associate and the Director.

Kaneohe Bay, the site of the Coconut Island Branch of the Laboratory, opens broadly to the sea over a protective, elevated reef and consists, throughout much of its extent, of many deep channels of varying width surrounding coral knolls or patch reefs which are nearly exposed at low tide. Each patch reef is fringed by an extensive growth of corals, comprising the finest development of reef coral growth in the Hawaiian Islands, and making the Bay one of the richest inshore collecting areas in Hawaii. Contrastingly, true oceanic conditions are found just outside the Bay, within a half hour by launch from the Laboratory.

The Laboratory and its environs offer ideal facilities for studies on all phases of the biology of tropical and subtropical fish and invertebrates. Comparatively little is known about the biology of such animals so that there is great latitude in the selection of research problems. The zooplankton of the Bay waters and of the neritic waters is exceeding varied and abundant in contrast to that of the oceanic waters farther from shore. Hawaiian shores abound with algae of all major groups. Of particular interest are four genera which offer special possibilities as subjects of physiological research—*Cladophora* because it is large-celled and filamentous, *Caulerpa* and *Codium* because they are unicellular, and the unicellular *Halimeda* because it produces abundant calcareous deposits.

Laboratory rooms are arranged to accommodate a varying number of investigators. Certain rooms are set aside for general use because of a concentration of equipment. Most electronic equipment such as spectrophotometers, radiological counters and scalers, pH meters, colorimeters, etc., are kept in a dehumidified-air conditioned laboratory. Such items as a Barcroft-Warburg Apparatus, International Centrifuge, and other standard physiological equipment are kept in a central chemical or physiological laboratory. A well equipped laboratory for radiobiological or radiochemical research has recently been built. Running sea water is available both for small aquaria in the Laboratory buildings and, at another location, for pools and large aquaria up to 20,000 gallons capacity. Several large tidal ponds provide near natural conditions for holding or rearing both large and small marine organisms. These large holding tanks and ponds have enabled the staff to study, under experimental conditions, pelagic animals never before subjected to such scientific manipulations. Outstanding studies on the behavior of schooling tunas and other pelagic fishes in regard to their responses to chemical, visual, auditory and electrical stimuli have been made here. Visiting investigators who wish to undertake studies especially suited to such facilities will receive our utmost encouragement.

Library facilities are excellent because the Laboratory takes advantage of the nearby University library and has working arrangements with the extensive scientific libraries of the B. P. Bishop Museum and the experimental stations of the Hawaiian Sugar Planters' Association and the Pineapple Research Institute.

The instructional program is considered equally as important as the research program. Its unique aspect is that it is a year-around instructional program at both the undergraduate and graduate levels where the essentially marine courses are given at a marine laboratory during the regular academic year, thus capturing all the stimulating experiences students receive from collecting, handling and studying live specimens. At the graduate level a full program is offered leading to the degrees of Master of Science and Doctor of Philosophy. To assist those who desire it, several teaching assistantships and research fellowships are available.

I should like to emphasize that I believe all biologists should make an effort to acquaint themselves with tropical fauna and flora. The multiplicity of species, phenomenal morphological physiological and ecological adaptations, and the riot of animal and plant colors cannot fail to broaden biological horizons, and sharpen scientific acumen.

The Lake Itasca Forestry and Biology Station of the University of Minnesota

T. SCHANTZ-HANSEN, *Director*

NESTLED among the pines on the east shore of Lake Itasca and not far from the point where the Mississippi River begins its long journey to the sea, is the Lake Itasca Biology Station which offers an unusual opportunity for the study of aquatic and terrestial biology in the northern coniferous forest. Itasca State Park, fifty square miles in area, has been a region which attracted people from the days of the prehistoric mound builders, through the time of early explorers and fur traders, to the tourists of today.

In 1907 the University established a camp where Forestry students could have their practical field training. It was, at first, a most primitive arrangement. As the years passed permanent structures for housing, feeding and teaching were erected. The unusual opportunities for biological studies were soon recognized, but it was not until 1935 that formal instruction in the various fields of biology began under the sponsorship of the Summer Session and various interested Departments. From this beginning, which was largely at the undergraduate level and of the nature study type, it has grown to its present stature where the work is at the graduate level and is combined with basic and fundamental research.

The entire park is available as a field laboratory to students at the station. Within its boundaries are lakes of many sizes from an area of one acre or less to several hundred acres, lakes with varying types of shorelines, and with different water and bottom conditions. There are lakes with a depth of only a few feet and lakes that have a depth of a hundred feet, lakes that have a constant level and lakes that fluctuate with the amount of precipitation. A wide variety of limnological studies are thereby possible. Within easy reach of the station, but outside the park are hundreds of other lakes and streams of all types.

The forests of the park are unusual. There is found a considerable area of virgin white and red pine stands which covered so much of northern Minnesota before settlement and is now almost all gone. Commercial logging and fires in years gone by have created a wide variety of age classes and types. Here the northern edge of the southern deciduous forest meets the coniferous forest and not far from the station the forest area gives way to the prairie. About forty miles to the northwest, lies the Red Lakes with their large bog area. Meadows along creeks and rivers, black spruce swamps, tamarack swamps and cedar swamps add to the variety of types available for study.

The variety of forest types indicates that there should be a wide variety of fauna, as well. This is true. The park is a game refuge, but has been open to deer hunting for the past few seasons. Before that the deer herd had built up to such proportions that a noticeable browseline was developing throughout the area. The carrying capacity of the area had been exceeded and hundreds of deer died from starvation every winter. Beaver, raccoon, mink, otter, porcupine, bear, and many smaller mammals are found in the forest. Opportunities for studying birds during the nesting season are especially good, since the bird life varies more with the timber type than do most mammals. Of course, fish are abundant in most of the lakes.

Lake Itasca Forestry and Biology Station, University of Minnesota.

The area is typical of any glaciated country. Eskers, moraines, glacial pot holes and, of course, the lakes of the region are typical features. The elevation is about 1500 feet above sea level and may vary several hundred feet in the morainic topography. Soils vary from light sand to heavy clay.

The physical plant of the station, while not elaborate, is adequate. Students are housed in eight-man cabins. Adequate bath and laundry facilities are provided. There are eight laboratories housed in four buildings. Equipment for the laboratories is transported from the University at Minneapolis. Ordinarily this consists of microscopes, collecting nets, various chemicals, etc. Arrangements can be made to provide special equipment needed for special studies. A limited but growing library is available. Adequate boats, barges, launches and motors are available for studies requiring water transportation.

The staff normally numbers nine. In 1954 the following individuals were on the staff: Lloyd Hulbert, University of Minnesota, Ecology; Alvah Peterson, Ohio State University, Entomology; Wm. H. Marshall, University of Minnesota, Wildlife Management; J. F. Hickey, University of Wisconsin, Ornithology; C. C. Christensen, University of Minnesota, Mycology; Samuel Eddy, University of Minnesota, Limnology; Thomas Morley, University of Minnesota, Taxonomy; Francis Drouet, Chicago Natural History Museum, Algology. In past years the following have been on the staff for one or more years and probably will serve again: A. C. Chandler, Rice Institute, Parasitology; Richard Evans, University of Wisconsin, Algology; Donald Lawrence, University of Minnesota, Micro-Climate; Murray F. Buell, Rutgers University, Ecology.

Instructional courses include the following: Aquatic Flowering Plants, Summer Flora of Minnesota, Vegetation Analysis, Organisms, Micro-Climate and Weather, Freshwater Algae, Bryophytes and Pteridophytes, Biology of Immature Insects, Field Entomology, Ecology of Terrestial Vertebrates, Mycology, Natural History of Invertebrates and Fishes, Limnology, Ornithology, Protozoology, Animal Parasites. Not all of these courses are offered every year. There are also courses involving research and special problems in all fields of biology.

The session comes during the early part of the summer and affords an excellent opportunity for research in ornithology during the nesting season. Other fields too offer excellent opportunities for research. The formal instruction covers a period of five weeks. It is hoped that this can be extended to at least six weeks in 1955. This is a short time to complete any significant research problem, but arrangements can be made to continue the work through the entire field season.

In the formal instructions and in the research problem an effort has been made to show that plants and animals live interdependently in communities. It is impossible to consider the ecology of animals without considering and understanding the ecology of plants. Since 1941 field work for nine Master theses and five Ph.D. theses have been carried on at the station; four in the botanical field, six in aquatic biology, and four in the field of animals and insects.

Probably the greatest contribution a station such as the Lake Itasca Forestry and Biological Station can make to research is the training of specialists in the various fields of biology. Interesting and worthwhile findings have been published in many fields. The breeding site of *Drosophila-laciolo*, long a puzzle to entomologists and geneticists was reported on by H. T. Spieth in 1951. New species of parasites in grouse and skunks have been reported on by A. C. Chandler. Important work is under way on the ecology of the wood frog by Wm. Marshall. These are but indicative of what is being done. What could be done is unlimited.

A summer at the Lake Itasca Biological Station is an experience in learning and a chance for inspiration not only in a professional, but also personal sense. It is an experience that will be long remembered.

The Kerckhoff Marine Laboratory

G. E. MacGINITIE, *Director*

The Kerckhoff Marine Laboratory, California Institute of Technology.

THE Kerckhoff Marine Laboratory of the California Institute of Technology is a part of the Division of Biology. It is situated fifty miles by car from the Institute at Pasadena. The post-office address is Kerckhoff Marine Laboratory, 101 Dahlia St., Corona Del Mar, California.

The laboratory, which was put into commission in 1930, is located near the entrance to the harbor on the east side of Newport Bay. It has an excellent salt water system and adequate collecting equipment, including a motor boat and dredges. A channel twenty feet deep at low tide leads out from the harbor between two rock jetties and, because of the protection afforded by the channel islands, it is possible to carry on boating activities practically any day of the year.

The laboratory is a two-story, concrete building with a third story contemplated. On the first floor (4,368 sq. ft.) are a large laboratory suitable for three or four research workers, a smaller laboratory and office for the person in charge, a photographic darkroom, a boatroom and launchway, a shop, and kitchen. On the second floor (3,788 sq. ft.) are a large laboratory suitable for several research workers but used as a classroom during the summer months, a smaller classroom, a physiological darkroom, dormitory, showers, stackroom, and office.

Classes in marine biology are held in the summer, the first six weeks being limited to CIT students, the following five weeks being devoted to biology classes from Pomona College. The Pomona classes, under the direction of Dr. Willis G. Pequegnat, are coeducational and a limited number of outside students is accepted for the summer course.

Research is carried on throughout the year, chiefly by members of the CIT Division of Biology and Chemistry, the emphasis being on experimental embryology, biochemical and biophysical problems, physiology, and ecology and natural history.

The late Dr. T. H. Morgan carried on research here with *Ciona*. By using an acid treatment he was able to obtain self-fertilization in eggs of *Ciona*, and developmental genetic characteristics were carried through several generations. Dr. Albert Tyler and his graduate students make continual use of the laboratory for their work in experimental embryology. Dr. Tyler works primarily on problems of fertilization and early development. Physiological research is carried on by Dr. C. A. G. Wiersma on the neurology of crustaceans. Dr. Dan Campbell (Dept. of Chemistry, CIT), in association with Dr. Paul Saunders (Univ. of Southern California), is at present engaged in physiological work related to the muscular activity of some of the marine animals. Dr. Findlay Russell (M.D.) is engaged in research on the relative toxicity and the nature of venom of certain marine fishes, particularly stingrays. Dr. Heinz Lowenstam (Dept. of Geology, CIT) is carrying on research correlating growth, temperature, etc. with the paleontological records of mollusks. Prof. G. E. MacGinitie and his wife have been engaged since 1932 in problems dealing with ecology and life histories of marine animals and have published a few papers on experimental embryology. Special attention has been given to the role of mucus in its relation to feeding activities.

Many marine animals are abundant and, for the most part, easily obtained for use in experiments. All classes

of mollusks are well represented, bryozoans and crustaceans are abundant, tunicates are common (*Ciona* and *Styela* exceedingly so), balanoglossids and *Branchiostoma* are available, four or five species of sea urchins are abundant and easily obtained, two species of sand dollars are available, as well as six or seven species of starfishes. Annelid worms, including *Chaetopterus,* and many coelenterates, including *Stylatula* (sea pen) and *Renilla* (sea pansy) are common. The echiuroid worm, *Urechis caupo,* with its sex products available throughout the year, is abundant. There are several species of sponges that thrive in the laboratory. Marine protozoa are found everywhere and flatworms are always available.

Sand-beach, mud-flat, and rocky-shore collecting are all within walking distance of the laboratory and other areas of all three types are within short driving distances. Dredging may be done within the bay and on the ocean bottom outside. Numerous floats and piling within the bay afford excellent collecting.

The research facilities of the laboratory are made available to visitors of established reputations and to graduate students who are doing work under the direction of CIT staff members. No living quarters are available at the laboratory during the summer but during the other months of the year three or four individual research workers can be accommodated at the laboratory. During the winter months living quarters in the vicinity are quite reasonable.

The University of Michigan Biological Station

A. H. STOCKARD, *Director*

THE University of Michigan Biological Station, founded in 1909 and operated at its present site for eight weeks each summer, is one of the oldest and largest of American biological stations. Situated in the northern tip of the Lower Peninsula of Michigan among the many inland lakes and within a short distance of three Great Lakes—Michigan, Superior and Huron—the Station enjoys relative isolation in a sparsely settled but biologically rich area famed for its pleasant summer climate, attractive vacation centers, and early American historical interest.

This portion of Michigan consists mainly of glacial deposits and old lake plains and beaches over a limestone substrate. The soil is mostly sandy, varied with numerous deposits of glacial till and humus. In addition to being surrounded by Great Lakes, the inland is richly supplied with large and small lakes and streams, boglakes, marshes, bogs, and reclaimed lakes. Though essentially a plane, it has numerous moraines, dunes and limestone potholes. There is some farming but most of the area is wilderness. The principal vegetation of the uplands is birch, oak, aspen, pines, and beech-maple; that of the lowlands is cedar, spruce, balsam, fir and tamarack. Because of its wilderness nature and varied topography, and because of its location in the area of overlap between the northern coniferous and the southern hardwood forests, and eastern and western biota, the region is rich in ecological situations and in numbers of both species and individuals of plants and animals.

The Station occupies an 8,850 acre tract of University-owned land in Cheboygan and Emmet counties, with eight miles of frontage on Douglas and Burt lakes, two of the larger and most attractive lakes in Michigan. The campus is connected by good roads with Cheboygan, twelve miles to the northeast, and with Pellston, six miles to the west. The postal address is Cheboygan, on U.S. 23 and 27 and the Straits of Mackinac; all other forms of address are through Pellston, on U.S. 31. Petoskey, Charlevoix and Traverse City, scenic Lake Michigan coastal cities, are short distances to the Southwest; and historically famous Mackinac City, St. Ignace and Mackinac Island are about twenty-five miles to the north on the Straits of Mackinac. The Station enjoys both seclusion and easy accessibility.

The campus covers thirty acres of terraced wooded ground bordering the southeastern bay of Douglas Lake, with its beautiful sandy beach and clear deep water. Ninety-six of the 144 buildings are residential, mostly single-room. Each is furnished to accommodate two or three persons or a small family. Included among the other forty-eight buildings are a health service, kitchen and dining hall, assembly hall, post-office and store, laundry, shower rooms, guest houses, library, aquarium, animal house, other general service buildings, and eighteen laboratories. In addition, there are ample fields, courts and other facilities for various forms of recreation.

The Station colony, resident from mid-June to mid-August, usually consists of about 250 persons—aproximately 35 undergraduate and 75 graduate students, 20 independent investigators, 15 faculty members, 20 staff members and other employees, and families. Usually about 40 percent of the students and investigators enrolled are residents of Michigan; the other 60 percent are residents of as many as thirty other states and foreign countries. In addition to its residents, the Station each summer is visited by as many as 500 biologists and friends, for whom meals and overnight housing are available.

All residents of the Station live in Station houses, which are plain but comfortable. All persons, faculty and others alike, take their meals in the dining room, which serves excellent meals under the management of a professional dietitian. Though study is dominant, the opportunities for recreation are varied and extensive. These include such individual activities as hiking, swimming, fishing, and visiting nearby historical and resort centers. There also is an organized program under the leadership of a trained social director, the Dean of Women. This program, in which all participate, includes lectures, pictures, parties, various games and sports, music and dancing.

The Biological Station is operated and financed, except for occasional research grants and fellowships, entirely by the University of Michigan, as a unit of the Summer Session. The purpose of the Station is to conduct courses and provide facilities, encouragement and direction for research on the physical and biological factors which govern the distribution, behavior and success of plants and animals in natural situations. The emphasis, therefore, is on ecology. The program includes courses and research on all of the major groups of plants and animals and on all of the major habitats and associations of the region. The studies include taxonomy, distribution, population changes, behavior, developmental and life histories, and the relationships within and among the several species of organisms and the physical factors of the environment, as well as genetic and other more purely physiological phases of biology.

Aerial View of Douglas Lake, University of Michigan Biological Station.

Though the Station is a unit of the University of Michigan, its faculty members are selected for their proficiency at teaching and research in the particular phases of biology for which they are chosen, regardless of any other association with the University of Michigan. As a consequence, the Station enjoys the services of a relatively permanent faculty of outstanding biologists from as many as ten leading colleges and universities. Faculty members in 1954 included the following: Elzada U. Clover, University of Michigan, Taxonomy of the Flowering Plants, Investigations in the Classification of Flowering Plants; Frank C. Gates, Kansas State College, Plant Ecology, Investigations in Ecology of Flowering Plants; Andrew J. Sharp, University of Tennessee, Bryophytes, Lichens, Investigations in Taxonomy and Distribution of Lichens and Bryophytes; Gilbert M. Smith, Stanford University, Freshwater Algae, Morphology and Biology of Algae, Investigations in Taxonomy, Life Histories, and Ecology of Algae; Frederick K. Sparrow, Jr., University of Michigan, Lower Fungi, Aquatic Flowering Plants, Investigations in Aquatic Fungi and Aquatic Flowering Plants; Stephen H. Spurr, University of Michigan, Investigations in Silvics; Paul C. Beaver, Tulane University, Biology of Parasites, Parasitological Methods, Investigations in Parasitology; David C. Chandler, University of Michigan, Limnology, Investigations in Limnology; William W. Cort, University of North Carolina, Biology of Parasites, Investigations in Helminthology; Charles W. Creaser, Wayne University, Biology of Fishes, Investigations in the Biology of Vertebrates, Investigations in the Biology of the Great Lakes; Frank E. Eggleton, University of Michigan, Natural History of Invertebrates, Investigations in the Natural History of Invertebrates; Herbert B. Hungerford, University of Kansas, Entomology, Investigations in Entomology; Olin Pettingill, Jr., Carleton College, Ornithology, Advanced Ornithology, Investigations in Ornithology; Alfred Stockard, University of Michigan and Director of the Biological Station, Investigations in Vertebrate Morphology; Frederick H. Test, University of Michigan, Biology of Terrestrial Vertebrates, Investigations in Natural Histroy of Vertebrates.

In addition to the courses and fields of investigation listed above, courses and research on the higher fungi, pteridophytes, gymnosperms and protozoans often are included.

The courses are not merely university courses transported to a favorable climate and environment for summer study; they are especially selected and built to fit the situation. Each course meets throughout the entire day or days assigned to it, thus allowing greater freedom for field studies. All courses require at least eight semester-hours of credit in biological science for election and some carry special or additional requirements. All give both undergraduate and graduate credit. Students may elect as much as eight hours of course work. Field conditions, laboratory space, equipment, supplies and transportation are adequate for effective study and work.

The research program is highly active. It is devoted to the advancement of the pure science of field biology. There is a group of projects centered around each of the fields of interest represented by the several faculty members, and research in other fields also is pursued. The individual topics under investigation usually number about one hundred, and each year between twenty and thirty of these result in publication. The number of published articles based on research done at the Station now totals more than 850.

Though many of the research areas are noteworthy, of special interest is the program on the Great Lakes. Instituted in 1954, and sponsored by the Great Lakes Research Institute of the University of Michigan, with the cooperation of the Department of Lands and Forests of the Province of Ontario, Canada, this program is centered at the Station. The program in 1954 was devoted to a synoptic survey of the physical characteristics of Lake Huron. In 1955 this survey will be extended to Lake Michigan, and a study of the biological features of Lake Huron will be undertaken, to be extended to Lake Michigan in 1956. It is hoped that Lake Superior will be brought under study in 1957.

In 1955 the regular session will begin on June 18 and close on August 13. Research workers are welcome at other times, as well. All students with good academic records, including at least one year of biological science and all professional biologists interested in doing research on field problems are invited to write to the author, c/o Biological Station, University of Michigan, for further information.

The Bermuda Biological Station

TALBOT H. WATERMAN, *Secretary*

Bermuda Biological Station, St. George's, Bermuda.

SITUATED on the emergent peak of an isolated sea mount rising precipitously from the depths of the Western Atlatic Ocean, the Bermuda Biological Station offers workers in the field of marine research and the outstanding advantage of a truly oceanic position coupled with a coral reef fauna and flora rich in tropical and subtropical forms. As a result of its fortunate site, this laboratory permits ready access to the study of various problems in physical oceanography and oceanic biology scarcely to be approached elsewhere.

Along the south shore of the Bermuda Islands the fringing coral reefs give way so rapidly to deep water that within 5-10 miles the 1,000 and 2,000 fathom lines may be surpassed. Consequently oceanic, bathypelagic and benthonic faunas are accessible literally within sight of the Biological Station. The north shore, on the other hand, is bounded by ten miles of lagoon and reefs where many aspects of reef geology and littoral ecology may be conveniently studied.

For the experimental biologist particular interest lies in the abundance of a number of important organisms. Among the algae *Valonia, Acetabularia* and *Caulerpa* are easily obtained. Echinoderms occur abundantly, and the breeding seasons of various species in succession provide embryological material during most of the year. *Amphioxus* is readily available, and there are large numbers of diverse littoral fishes. Squids are numerous at certain seasons. Decapod shrimps and various teleosts are the commonest microscopic forms obtainable from the bathypelagic fauna.

In addition, from the point of view of the whole North Atlantic circulation, Bermuda's location is of great strategic value, lying as it does East and Southeast of important stretches of the Gulf Stream. Scientific recognition of this advantage is reflected in the program initiated just prior to World War II under the auspices of the Royal Society of London in the Oceanographic Observatory of the Woods Hole Oceanographic Institution recently established at the Bermuda Biological Station (Nature, *173*, p. 886, 1954).

Furthermore, the geographical location of the laboratory on the western edge of the Sargasso Sea provides a climate suitable for collecting and other field work throughout the year, a factor important not only for the biologist but also for the marine geologist and oceanographer. Despite these advantages of position, the station is only 660 miles (about three hours by air) from New York.

The Bermuda Biological Station operates primarily as a research facility for visiting investigators, although certain programs of investigation are conducted by the laboratory itself. It is open throughout the year to all qualified investigators concerned with any phase of marine research, whether biological, chemical, or physical, and to others conducting scientific investigation in the Bermuda Islands. A limited number of non-working visitors also may be accommodated as friends of the Station when space permits.

Support for the Station is drawn from the original endowment given by the Rockefeller Foundation, grants from the Bermuda Government, special grants and gifts from other sources, and by rents and fees.

The property of the Bermuda Station consists of a fourteen acre tract on St. George's Island and fronts on Ferry Reach. The main building contains offices, a lounge, dining room, laboratories, two apartments and about twenty single dormitory rooms. A second building houses additional laboratories, carpentry shops, and a storage loft. Other buildings on the property include the E. L. Mark Memorial Library, the Director's house, four cottages, and two dwellings which provide six small housekeeping apartments. A jetty, pump house, and tide gauge are located on the Ferry Reach Shore.

Eight laboratories in the main building and four in the new building accommodate from one to several workers each. In addition, one laboratory is fitted primarily for physiological work and contains routine chemical equipment. There are two darkrooms, a cold room, and a dry room. Running salt water with a salinity of about 35 o/oo is distributed to salt water tables on the verandas outside the laboratories and four large concrete tanks and two aquarium racks in the aquarium rooms. Outdoor tanks provide additional space for holding live material.

Small stocks of routine glassware and reagents are maintained and certain equipment, such as pH meter, microscopes, microtomes, balances, and cameras are available in limited quantities. All investigators, however, are requested to submit a detailed list of their needs before arrival, so that they may be advised of what is available. Certain supplies, such as preserving jars and vials, photographic materials, microscope slides and cover slips, and similar items are normally stocked by the Station for sale at cost.

A wide variety of collecting grounds are readily accessible from the laboratory, including coral reefs, rocky and sandy shores of varying degrees of exposure, shallow bays and lagoon, and mangrove swamps. Deep water can be reached within an hour's time.

The Station's equipment includes a thirty foot launch, fitted with a winch and live well. Gear, such as dredges, grabs, seines and nets of various sorts, water glasses, diving helmets, aqua-lungs and skiffs are available. At present, the Station has the use of a sixty foot research vessel, the *Panulirus*, on loan from the Bermuda Government. This ship is equipped with hydrographic and trawling winches, as well as a fathometer and radio-telephone. These two boats are in charge of experienced collectors, who assist investigators in the field or bring desired material to the laboratory.

The E. L. Mark Memorial Library contains a small number of journals, expedition reports, and standard works on biology and marine research. There is, in addition, a reprint collection.

Research fees for use of ordinary Station facilities are charged at a rate of $100 a month for a senior investigator and $50 a month for each assistant. The fee for graduate students is $50 a month. Projects making unusual demands on Station facilities, particularly on boat time, are charged an additional fee determined in each case by the Director in consultation with the investigator.

Various Fellowships or Grants-in-Aid are available from time to time. The National Science Foundation has recently made a considerable grant to be used for financial assistance to investigators working at the Station. Applications will be considered from senior investigators as well as qualified graduate students.

Further specific information about the Bermuda Biological Station may be obtained from the Director, Dr. W. H. Sutcliffe, Jr., Bermuda Biological Station, St. George's West, Bermuda.

VIII International Congress For Cell Biology

JOHN S. NICHOLAS, *Yale University*

The Congress at Leiden was an unqualified success in international as well as scientific relations. Approximately three hundred persons attended the scientific sessions. The hospitality shown us by the Dutch committee and their eagerness to contribute to our welfare during the meetings furthered the acquaintances already made and helped the feeling of scientific fellowship so essential to the furtherance of science.

The meetings were arranged to give the maximum opportunity for the specialized research workers to delve in the minutiae of their own fields as well as to secure general information and summarized results in cognate subjects.

This plan was ably worked out by the Dutch Committee using Plenary sessions in which the Chairman of each of the afternoon Sections was put to work in the morning for the generalized view of the material to be presented in his section during the afternoon. The plan is exceedingly logical but demands the cooperation of the chairmen who must be chosen for their ability to coordinate the results in the field. This some of the chairmen found difficult to achieve. The results of the planning were excellent in general.

The individual sections met in the afternoon and the program was so arranged that the investigations reported followed the lines of the Plenary sessions of the morning. For instance, the topics of the first day were, Induced Enzyme Synthesis, Formation of Intercellular Substance in Animal and Plant Tissues, and Immunobiological Concepts of Cellular Growth and Differentiation.

The details of other days cannot be given here because of space limitations. Those interested will find the complete abstracts of the papers delivered in Excerpt Medica, Vol. 8, No. 9, September 1954, where Professor Woerdeman used not only the author's text but arranged the work presented under convenient scheduled topic headings.

While the days were packed with work and discussion, the Committee planned also for relaxation. Their care of the details of receptions, smokers, banquets, and teas added that social touch which means so much to the general felicity of an international gathering. The International Committee and the Organizing Committee were well coordinated in the general and specific handling of the Congress. Professors Gaillard and Karstens, with the able assistance of the organizing group, conducted a superb meeting both of minds and of spirit. *Well Done* is a short phrase which only partially expresses our appreciation of their efforts.

Tenth World's Poultry Congress

T. C. BYERLY, *Chairman, U.S. Delegation*

The Tenth World's Poultry Congress was held in Edinburgh, Scotland, August 13-21, 1954. The Congress was sponsored by the Government of the United Kingdom and the World's Poultry Science Association. More than 1,000 persons participated as full members or delegates from 53

countries. The United States participated officially in the Tenth Congress through a delegation of 20 members. In addition, about 140 other U.S. members, from more than 23 States, were in attendance.

The scientific sessions opened with a plenary session at which J. E. Wilson, Director of the Scottish Ministry of Agriculture Poultry Laboratory, summarized recent progress in poultry disease research. Dr. T. H. Jukes, Lederle Laboratories, Pearl River, N.Y., summarized recent progress in poultry nutrition research and Dr. I. M. Lerner of the University of California, discussed the present state of knowledge in poultry genetics.

The technical sessions on economics and marketing and on husbandry included papers describing production and marketing practices in the United States, Scotland, Finland, Nigeria, India, Israel, Thailand, Switzerland, England, and France. Dr. Hans Engler, representing the Food and Agricultural Organization and vice-president of the World's Poultry Science Association, addressed the triennial meeting of the Association and urged increased membership and cooperative activity.

The technical sessions on genetics, nutrition and disease were excellent. The meeting rooms were crowded with attentive people. Each paper was summarized briefly by its author, with immediate, excellent French or English translations. Discussion was active and productive. Noteworthy in this area was the debate on avian leukosis. Dr. F. B. Hutt of Cornell, defended against many challengers the thesis that the avian leukosis complex should be treated as a single entity, transmitted chiefly from adult infected flocks to chicks under six weeks of age and that egg transmission is unimportant or nonexistent.

The weight of evidence from our Regional Poultry Research Laboratory and from Scottish laboratories and field experience has demonstrated the fact and importance of egg transmission and existence of separate disease entities within the avian leukosis complex. The vigorous debate on this topic aided greatly in informing poultrymen from many countries of research findings in this field.

The members of the U.S. delegation were especially impressed by the research institutions they visited. Some saw several, some only the Poultry Research Center, established by the Agricultural Research Council at Edinburgh in 1947 with Dr. Alan W. Greenwood, F.R.S.E., as Director. This institute has a staff of 16 scientific research workers in genetics, biochemistry, physiology, pathology, animal behavior, and cancer. Facilities are of limited capacity but exceptional quality. The research program permits very broad latitude, initiation and pursuit of research problems in the biology of poultry without immediate necessity of application of results. This freedom for research for its own sake was envied by many workers from the United States who must be ever conscious of the need to justify the expenditure of funds for the research in which they engage in terms of practical value from immediate application of the results.

On the other hand, many people associated with the British poultry industry are questioning whether the excellent research results obtained in their institutes are being made available in terms understood by the layman for his use. Many discussions were stimulated by the obvious contrast between the research and educational organization in the United Kingdom and the United States. Both countries may benefit through consideration of the other's method of approach.

The U.S. delegation recommended official participation in future World's Poultry Congresses. A United States National Committee of the World's Poultry Science Association will continue to function in anticipation of such participation.

Publication Plans

W. R. DURYEE,

Chairman, AIBS Publications Committee

AT THE Gainesville Convention September 7th a widely attended meeting was held on the topic of "Communication of Research Results" sponsored by the AIBS Publications Committee. The symposium will serve as a base line for a carefully-planned series of meetings, articles, and substantial grant-supported programs. It is proposed that by 1960 biologists will gain more informative, shorter articles, better edited and titled, correctly indexed and abstracted and perhaps even findable by new methods of machine searching. Scientific workers in every branch of biology should realize, however, that achievement and real improvement can be brought about not just by committee work, but by scientists and editors themselves, who will think, plan and cooperate in the tough job of improving publications.

Our symposium was held under the able chairmanship of James Bonner of California Institute of Technology. To John Behnke is due great credit for organizing the program. His report of the papers appeared in a recent issue of *Science*. Only a few details can be included here.

The first paper by the writer (W.R.D.) attempted to portray the overwhelming situation in larger libraries, where up to 20,000 biological journals compete not only for scanty shelf space, but also for publication funds and for the biologist's time. My suggestions, optimistically termed a "blue print," centered on plans for a *single* national indexing service, coordinated with present abstracting services such as Biological Abstracts. If our objectives are to be: more information, fewer words, and greater ease of finding, we will need some sort of regional duplicate depositories perhaps operated by a few large university's libraries under supervision of the Library of Congress. Here the *related, key-indexed, editorially* deposited bulky data for each paper could be stored, reproduced and mailed as needed. It is judged that, if AIBS society journals will start some such system, many others can be expected to follow suit.

Next Robert Bray of the Library of Congress described several new methods of reproducing printed scientific information rapidly and cheaply. He pointed out that it may be necessary to invent new devices, tailor-made for our expanding bibliographic needs. Readers will be interested in The Committee's sponsorship of an experimental facsimile transmission hook-up between The Library of Congress and The National Institutes of Health Library 14 miles away. Over an early model RCA transmitter-receiver line printed articles, line drawings and bibliographies may be delivered on request, and handed to the user in a few minutes. Should you think this, or similar ideas are good, please say so by card or letter to the AIBS. It might be worthwhile to tactfully prod your local librarians and administrators to look into the several commercial types now becoming available, since commercial companies often need to be made aware of the demand.

A third paper by Ralph Shaw, former librarian of the Department of Agriculture described the principles and proven value of a linear Rapid Selector in comparison with other information recovery machines. This device is described in his article in the July issue of the *AIBS Bulletin*. If financial support can be found by the Committee for an improved simplified model, biologists should be nearer their goals.

Another approach to the problem of improved manuscripts and scientific communications was forcefully and humorously described by Richard N. Hewitt of the Mayo Foundation.

His emphasis was on better writing, shorter tables, clearer illustrations. His plea for clarity and brevity might be compared with another proposal—namely that titles be limited to simply ten key words, designed to make indexing more accurate and less hazardous.

Finally Ralph Cleland provided much interest and a valuable suggestion in describing a possible weekly scientific newspaper. Concurring with the previous speakers on the almost desperate needs of scientists in small institutions, his estimates on savings and readability were impressive.

In a general discussion following the papers reservations concerning costs, desirability and reader psychology were brought out. On the other side enthusiasm for vigorous and continued search for improvements was expressed. The Committee on Publications looks forward to planning a conference of 60 selected Editors of biological journals next summer. Concurrently it proposes to seek funds for a long-range program of evaluating and enumerating biological journals that merit abstracting, and a parallel grant to explore new indexing principles and new titling procedures. It is realized that workable and acceptable systems will be slow and difficult to obtain, but with the help and cooperation of individual AIBS members and their societies, biologists will eventually gain improved intellectual tools for producing, disseminating and recovering printed knowledge.

Southeastern Work Conference on Biology Teaching

SCIENTISTS and educators are becoming increasingly aware of the need for better communication among workers in the numerous special fields and teachers and administrators from all levels of the school system in order to lay a groundwork of common understanding which can serve as a sound basis for cooperative attack upon the urgent problems of science teaching. Recognizing this need, the National Association of Biology Teachers in cooperation with the AIBS sponsored the Southeastern Work Conference on the Teaching of Biology at Gainesville, Florida, August 28-September 6. Among the 94 invited delegates were high school teachers, science supervisors, representatives of state departments of education, college professors of biology, botany, zoology and science education, and university administrators. In group discussions, meetings of the full conference and many informal gatherings these varied members of the educational team had an instructive opportunity to exchange information, problems and viewpoints, and to develop initial action programs.

Most of the delegates represented the 10 Southeastern States but nearly a score came from other parts of the country, including representatives of the AAAS, AIBS, NRC and NSF. The Conference was financed by a $15,000 grant from the National Science Foundation and was led by Richard L. Weaver of the University of Michigan and Samuel L. Meyer of Florida State University as co-directors and Ned E. Bingham, University of Florida, Hugh Stickler, Florida State University, and George Jeffers, Longwood College, as staff members.

The Conference examined four main topics: 1) the appropriate content of biology courses and curricula in the fields of morphology, physiology and health, ecology and conservation, heredity and development, taxonomy and evolution and paleontology; 2) problems of biology teaching in high school and college; 3) adequate education of the high school biology teacher; 4) the role of state departments of education in improving biology teaching.

Much discussion centered upon the acute and growing shortage of qualified high school biology teachers. At present only 60% of high school biology teachers have a college major in a biological science. What augurs worse for the future, the numbers of college students preparing for teaching careers in science are declining while high school enrollments mount steadily. To counteract these serious conditions the Conference proposed two courses of action: 1) improvement of the status and work conditions of the teacher; 2) improvement of teacher-training programs, both to insure better qualified graduates and to present a course challenging to a larger fraction of the more able college students.

The Conference urged the adoption of teaching salary and pension scales more nearly comparable with those in industry and government. Greater support is needed from administrators in the recognition of the importance of good science instruction in the high school curriculum, in providing time and facilities for laboratory and field work, and in support of special help to talented youth who may then become interested in science and science teaching.

The delegates outlined a minimum course of study for the prospective biology teacher, including: 1) broad education in the humanities, communication arts and social sciences; 2) education courses as required for certification, and including a course in methods of teaching biology and practice teaching; 3) a college major in biology, with a one year course in General Biology, or equivalent courses in General Botany and General Zoology, advanced courses in both plant and animal sciences, and stress upon field and laboratory experiences; 4) one year each in chemistry, physics and mathematics, and one or more courses in geosciences. Since most beginning biology teachers are asked to give instruction in mathematics or other sciences, the student will be well advised to acquire an even wider background of physical science.

The Conference further recommended that college biological departments devote study and attention to the needs of teachers. For example, there is need for summer institutes where the teacher can become conversant with modern developments in the field. A greater variety of course offerings in summer sessions would encourage teachers to take graduate work in their science rather than in education. The prospective teacher needs help in learning how to take advantage of the local biota in his classroom.

As its final step, the Conference asked each state delegation to develop plans for implementing these and many other recommendations. Challenging programs were drawn up, many of them insuring the continuation of conferences within states to include representatives of all groups interested in biology teaching.

A full report of the Conference will be published in the January number of the *American Biology Teacher*.

Know Your Associates

This column was begun in the October 1954 issue of the BULLETIN and will be continued in the April 1955 issue. It is hoped that BULLETIN readers will become acquainted, through this series, with the concerns that contribute to the advancement of biology, through Associate participation in the AIBS.

Monsanto Chemical Company

St. Louis, Missouri

Monsanto Chemical Company, which was founded in 1901, is one of the largest chemical producers in the United States in both sales and assets. It operates 20 plants in the United States which manufacture more than 400 products in 20,000 or more formulations.

In addition, the company has subsidiaries and affiliated companies in Great Britain, Australia, Canada, Argentina, Mexico, India, Japan and France. Sales offices are located in principal cities throughout the world. There are more than 19,000 employees in this worldwide organization.

In addition to maintaining laboratories at each of its plant sites, Monsanto has a research laboratory at Akron, Ohio; Creve Coer, Mo.; Dayton, Ohio; Everett, Mass.; Monsanto, Tenn.; Nitro, W. Va.; St. Louis, Mo.; Santa Clara, Calif.; Seattle, Wash.; Springfield, Mass., and Texas City, Texas. Monsanto also operates Mound Laboratory at Miamisburg, Ohio for the Atomic Energy Commission.

Monsanto participates in the ownership of three domestic affiliates: The Chemstrand Corporation, Mobay Chemical Company and Shawinigan Resins Corporation.

The Chemstrand Corporation is owned jointly with American Viscose Corporation and was formed for the development and manufacture of synthetic fibers. A plant at Decatur, Ala. manufactures acrylic fibers and, at Pensacola, Fla. Chemstrand is operating the first completely integrated plant for the manufacture of nylon fibers.

Mobay Chemical Company is owned jointly with Farbenfabriken Bayer, A.G. of Germany for the development and manufacture of isocyanates and polyester resins as well as other ingredients for the conversion of these materials into flexible and rigid foamed plastics, wire coatings, paints, new synthetic rubber formulations and adhesives. Mobay is currently constructing a plant and research operation in West Virginia near Martinsville. When completed, this will be the first full-scale production plant for isocyanates in the United States.

Shawinigan Resins Corporation is jointly owned and operated by Monsanto's Plastics Division and the Shawinigan Products Corporation. The plant, located at Springfield, Mass., manufactures resins and resin emulsions.

Charles Pfizer and Company

Brooklyn, New York

Chas. Pfizer & Company, a 105-year-old fine chemical and pharmaceutical house with plants and laboratories in Brooklyn, N. Y., Groton, Conn.; Terre Haute, Ind.; and Maywood, N. J.; is perhaps best known for the discovery of the wide range antibiotic, Terramycin, and for its development of mass production techniques for this and other antibiotics. Pfizer is now the world's leading producer of antibiotics including penicillin, streptomycin, neomycin, and numerous others.

Fermentation chemistry, backed by teams of mycologists, biochemists, pharmacologists and physical chemists, has led Pfizer into many new fields. From its earlier role as a major supplier of antibiotics, vitamins and citric and other organic acids to the pharmaceutical and food industries, Pfizer has recently extended its research into other areas.

The discovery that hydrocortisone could be made more easily by a fermentation process from more readily available starting materials has led Pfizer to a program of research into fermentation production of steroids. The discovery that small quantities of Terramycin accelerate growth and control disease in livestock was the foundation for Pfizer's 700-acre experimental farm in Terre Haute, where nutritional and health studies on animals are now underway on the role of vitamins, antibiotics and hormones.

During their investigation of the structure of Terramycin, the company's chemists isolated the newest wide range antibiotic, marketed as Tetracyn by Pfizer's J. B. Roerig and Co. Division. Discovery of other important new antibiotics—viomycin for tuberculosis, Magnamycin, thiolutin and others—has encouraged Pfizer to continue its soil screening program in the search for new agents which will be effective against viruses and parasites now unchecked.

The company's Pfizer Laboratories division, extending its line of pharmaceutical products sold under the Pfizer label, is interested in any important new products, such as Bonamine, an improved anti-motion sickness drug giving longer protection with one dose than any other now available.

An extensive program of research into plant disease and nutrition has also engaged Pfizer scientists' attention, with the result that Agrimycin, a combination of Terramycin and streptomycin, is now being tried by hundreds of fruit growers throughout the country and promises to help control fire blight and other important bacterial infections of crops and orchards.

A solid base for the company still remains in the chemical sales division, now selling more than $30 million worth of Pfizer fine chemicals and antibiotics to industry. Pfizer's total net sales have climbed from $60 million in 1950 to over $127 million last year and are still on the increase.

The expansion of research facilities at Terre Haute, Maywood and Groton (site of the company's virology laboratories) promises still more important discoveries leading to better medicine and nutrition for all.

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